The Newsletter of the Australian and New Zealand Society of Paediatric Dentistry

Synopses

June 2014, ISSUE 51

2012 Louise Brearley Messer ANZSPD Post-graduate Essay Competition

"Discuss the philosophy of minimally invasive dentistry and the application of minimally invasive techniques in the paediatric and adolescent dental patient"

Dr Maria Pandey BDS (Adel)
Paediatric Dentistry Program, Melbourne Dental School
Melbourne Dental School, University Of Melbourne.

Introduction

The philosophy of minimally invasive dentistry (MID) as it relates to children and adolescents primarily encompasses prevention of disease, risk identification and minimal restorative intervention for the management of dental caries and can be extended to all other areas of oral health. The current knowledge of the caries process and advancements in caries detection technology provide the ability for early identification of children and adolescents at risk of developing dental caries, allowing the implementation of preventive strategies. The development of adhesive technologies has allowed the clinician to preserve tooth structure with the aim of keeping the dentition healthy and functional for the patient's lifetime.

Dental Caries and Biofilm

Dental caries is the most common, preventable, chronic childhood disease affecting Australian children and adolescents (1). It is dynamic in nature, cycling between periods of demineralisation and remineralisation. Demineralisation occurs due to the action of organic acids produced by bacteria residing in dental biofilm, and results in the net loss of mineral from the tooth surface into the surrounding environment. When the environment at the tooth surface contains sufficient calcium and phosphate ions to achieve saturation or above with respect to tooth mineral, remineralisation can occur via a concentration gradient (2, 3).

Bacteria adhere to the tooth surface via the pellicle and form a biofilm, which helps protect the bacteria from the oral environment. The location of adherence is important for the survival and growth of the bacteria. Inter-proximal sites, deep pits and fissures and areas close to the gingival crevice provide further isolation from saliva, masticatory forces and oral hygiene practices. Undisturbed biofilm can change its physical and chemical properties according to the predominating microorganisms and is affected by host factors including, in no specific order: tooth morphology (deep pits and fissures), developmental dental defects (hypoplasia, hypomineralisation), crowding, immature enamel on newly erupted teeth, salivary characateristics, medications, orthodontic appliances, hygiene practices and especially diet. Frequent consumption of fermentable carbohydrates has a significant influence on biofilm properties, promoting growth of aciduric and acidogenic cariogenic bacteria (4). As a diverse range of microorganisms develop in the biofilm, both symbiotic and amphibiotic relationships exist (5, 6).

When the balance between remineralisation and demineralisation is disturbed, and demineralisation predominates, the carious process progresses to further loss of tooth structure and eventual cavitation. The initial loss of mineral from the tooth results in

CONTINUED ON PAGE 2...

THIS ISSUE

a change in the optical properties of the enamel and a white spot lesion is visible clinically.

Historical management of dental caries

The 'extension for prevention' approach recognised the increased caries susceptibility of pits and fissures and inter-proximal areas. Cavity preparations included removing these susceptible areas and proximal margins were extended to the buccal and lingual line angles. Removing healthy tooth structure was thought to prevent further development of caries and provide 'self-cleansing' restorative margins (7).

Non-adhesive direct restorative materials such as amalgam and gold foil relied on physical retention and large cavity designs were required for adequate retention and resistance forms (7).

Development of MID

Large intra-coronal restorations weaken tooth structure, sharp internal line angles concentrate stress and self-threading pins cause cracking in the tooth structure, all contributing to an increased risk of tooth fracture (8, 9).

The development of adhesive resin-bonding systems has provided the possibility of minimally invasive operative interventions, including the repair of restorations, preventive resin restorations, fissure sealants and resin infiltration. Extending cavity preparations into healthy tooth structure is no longer indicated (7, 10).

The removal of the fully demineralised infected dentine only was advocated as it was believed that infected dentine had lost architectural integrity and could not be 'healed'. Clinicians were encouraged to leave the partly demineralised affected dentine in situ allowing remineralisation under a well sealed and maintained restoration (11). This process conserved tooth structure, reducing the restorative burden on the tooth, however the difficulty lay in determining clinically what was infected and affected (12-14).

Prevention

Caries management is shifting from surgical intervention to a risk-based caries prevention and management approach (2, 15).

Caries Risk Assessment (CRA)

Caries risk is defined as the "probability of future dental caries disease development" (14). Although dental caries is a multi-factorial and dynamic disease, a CRA gives the clinician an idea of the child's caries activity at the time of the assessment, with past caries experience illustrating past risk. The determination of caries risk provides the clinician an opportunity to develop an appropriate treatment plan and recall period for each individual (14, 16, 17).

A small percentage of the child and adolescent population harbour the majority of the disease burden (18). The CRA is an important public health measure to help reduce the burden of disease by identifying populations at risk of developing dental caries, and is demonstrated to be most effective in children and adolescents in the early stages of dental caries (14, 16, 19).

Many CRA models help the clinician develop a subjective understanding of a patient's caries risk (20-22). An informal CRA is often completed by the clinician at every visit. Previous caries experience and socioeconomic status remain the best predictors of future caries development in the permanent and primary dentition (23). The development of caries in a very young child can be positively correlated to the presence of plaque on the labial surfaces of the primary teeth, the derivation of the 'lift the lip' program (24). A structured protocol for CRA investigating a variety of risk factors is considered the best clinical practice to help provide the patient with a personalised treatment plan and enhance patient motivation. An individual's caries risk is not static, and change can occur, for example after the eruption of the first and second permanent molars, after the placement of orthodontic appliances, a change in lifestyle, the onset of pregnancy and at the onset of chronic medical conditions such as asthma and diabetes. It is recommended that a structured protocol CRA is performed by the dentist every two years, in addition to any individual events such as those described above (25).

The CAMBRA (Caries Management by Risk Assessment) protocol has been validated in adults and the CARIOGRAM (26) protocol has been validated in school children, adults and the elderly, but is not as useful for preschool children and infants (22, 25, 27).

The CRA for a patient involves taking a thorough history:

- Current illnesses and medications and any saliva reducing factors.
- Episodic dental care, previous caries history of child and primary care giver, developmental milestones of child, lifestyle and recreational drug use.
- Dietary analysis (including frequent snacking more than three-times-daily), on-demand feeding, sleeping with bottle (other than water) in younger children.
- Oral hygiene, use of fluoridated toothpaste, water fluoridation, sugar-free chewing gum, additional therapeutic agents.
- Oral environment including high levels of plaque on teeth, areas of demineralisation (white spot lesions), visible cavities, salivary flow rates and buffering capacity, deep pits and fissures and orthodontic appliances. (20, 21)

Cariogenic bacteria testing has been recommended by some authors (2, 12, 20, 21).

Early Caries Lesion Detection and Diagnosis

The aim of early caries detection is to determine the presence and activity of a carious lesion. Early detection and intervention can prevent further loss of tooth structure due to caries. New technologies are being developed to enhance caries detection in approximal sites, and improve detection of white spot lesions (WSL), and potentially subclinical lesions (28).

Visual Inspection:

The visual inspection (VI) of an adequately air-dried tooth with good lighting has been the basis of caries detection (29, 30). Visual inspection without tactile sensation remains a benchmark for caries detection. Visual inspection of approximal surfaces is often difficult, as the carious lesion exists at or below the contact point. Visual inspection of approximal primary teeth contacts is further confounded by the presence of flat wide contacts. Tooth separation with an elastomeric separator has been demonstrated to aid approximal visual examination (31). Further caries detection adjuncts are often necessary (32). Furthermore, passing floss along the approximal surface, below the contact point can give the clinician an

indication of tooth surface integrity. Tactile detection with a sharp probe can cause iatrogenic damage to a delicate non-cavitated tooth surface so should be used judiciously, and for pits and fissures provides no valid information regarding the status of the tooth surface (33).

Historically, caries scoring systems did not include pre-cavitated lesions, and dental caries was significantly underestimated (29, 34). A universally accepted scoring system is yet to be established; however several systems have been developed to include WSL. The International Caries Detection and Assessment System (ICDAS II) provides a standardised and validated data collection system; the American Dental Association Caries Classification System (CCS) is yet to be validated; the Caries Assessment Spectrum and Treatment (CAST) index is currently only used for epidemiological studies. A FDI World Dental Federation Caries Matrix has been developed to attempt to join together the current systems, allowing the clinician to continue to use their preferred system and concurrently allow comparisons between each system (14). Regardless of the system used, scoring of the WSL enables the clinician to monitor and assess the effectiveness of their preventive program (35).

Magnification

The development of dental loupes has provided the clinician with easy access to low powered magnification. Low powered magnification has been demonstrated to improve caries detection significantly when compared with conventional VI (36).

Detection technology

Radiography remains the most accurate adjunct for VI when examining approximal surfaces (37). Consecutive radiographs can provide a measure of carious lesion progression/regression monitoring over time. The development of digital radiography (DR) provides the advantage of lower radiation dose and limits conventional human processing errors (38). The digital image can be enhanced by altering the coordination of the pixels, allowing different parts of the image to be moved, changing the colours and magnification of the image. However, neither conventional nor digital radiography are reliable when detecting early caries lesions in enamel, especially in pits and fissures (38, 39).

Fibre-Optic Transillumination (FOTI) enhances the presentation of a carious lesion using a high intensity white light. The carious lesion appears darker in comparison to healthy tooth structure. Fibre-Optic Transillumination can be used approximally; can be appropriate for occlusal surfaces; is easy to use and non-invasive. Fibre-Optic Transillumination has been reported to have high inter- and intra-examiner variability although with training, can produce high specificity and sensitivity values (40, 41). For children who cannot tolerate radiography, FOTI remains the best alternative to assess approximal lesions (37).

Accurate and early caries detection in pits and fissures is difficult with VI and radiography. Laser induced fluorescence at a wavelength of 655nm was developed to enhance detection however; conflicting results have been reported (42-44). KaVo Diagnodent® consistently displays high specificity in detecting occlusal caries, however repeatedly presents with high false positive readings, resulting in a low sensitivity. Although cleaning the tooth to remove calculus, debris and exogenous staining has reported to improve sensitivity, Diagnodent® is still affected by tooth mineralisation, demonstrating more false positive readings with hypomineralised enamel. Sensitivity is lower in primary teeth where enamel is thinner and more porous (43, 44). The Diagnodent® pen, designed for approximal caries detection, has not demonstrated superior approximal caries detection to Diagnodent designed for occlusal lesions (37). KaVo Diagnodent has been demonstrated to over-estimate approximal enamel and dentinal carious lesions (37, 45), and possesses lower sensitivity and specificity compared to VI used with DR (37).

Quantitative light induced fluorescence (QLF) at light wavelengths including 404nm and 450nm is currently commercially available and is reported to detect subclinical and clinical carious lesions on smooth surfaces (46). Enamel will fluoresce as a result of light absorption, and the demineralised area of enamel will appear to be darker than healthy tooth structure due to light scattering (47, 48). Further research is required, however promising results demonstrate the ability for QLF to detect, quantify and monitor the progression and regression of a lesion over time (37, 48).

Digital photography (DP) is useful for diagnosis and treatment planning, patient communication and monitoring over time and it is portable. Disadvantages with DP include confounding effects due to flash reflection and subjective interpretation of colour and grey levels (49).

Prevention, Intervention and Remineralisation

Appropriate prevention and intervention strategies should be developed for each individual patient. Non-cavitated carious lesions can be remineralised with improved oral hygiene and dietary habits and appropriately used therapeutic agents.

Fluoride

Fluoride is an important public health measure to prevent dental caries and can be delivered via water, milk, salt, toothpastes, mouthwashes, and professionally as varnishes, gels and foams.

Fluoride acts to inhibit demineralisation by making ionic saturation with respect to tooth mineral easier to obtain at the enamel surface and preferentially incorporating fluorapatite into the tooth structure, decreasing solubility. Fluoride enhances remineralisation by attracting calcium and phosphate ions to the tooth surface and increases precipitation rates of mineral (14, 50). Finally, high concentrations of fluoride can interfere with cariogenic bacterial metabolism enough to affect the carious process, by affecting trans-membrane proton transport and interfering with bacterial enzymes (50).

Self-administered topical fluoride, delivered in any vehicle, is most effective when used frequently over a long period of time (50-52). Compliance is often an issue and caries reduction can also be achieved by professional fluoride varnish application two to four times per year, in high risk children and adolescents. The benefit of professionally applied fluoride gels and foams is inconclusive (53).

Casein Phosphopeptide Amorphous Calcium Phosphate (CCP-ACP)

The remineralising action of fluoride is limited by the bio-availability of calcium and phosphate. Calcium and phosphate ions are available in the mouth via saliva and gingival crevicular fluid, and from dissolved dental hard tissues. Hydroxyapatite remains in equilibrium with the calcium and phosphate ions in saliva at the tooth surface. During periods of high acidity, the hydrogen ions react preferentially with phosphate in the saliva,

removing phosphate from the equilibrium. Following the concentration gradient, the saliva is under-saturated with respect phosphate and hydroxyapatite dissolves, a process called demineralisation. Demineralisation continues until the tooth is once again in equilibrium with the calcium and phosphate in the immediate aqueous environment (54).

The development of CCP-ACP allows the stabilisation of calcium and phosphate ions near the tooth surface, promoting remineralisation and preventing demineralisation by maintaining a supersaturated environment (55). When delivered as a tooth cream, CPP-ACP has been demonstrated to "significantly enhance the regression of white spot lesions" (55). Casein Phosphopeptide Amorphous Calcium Phosphate with fluoride, is recommended for children over the age of ten years, with increased retention of fluoride in plaque in comparison to CCP-ACP alone. Chewing gum with CCP-ACP is also available commercially.

Silver Diammine Fluoride (SDF)

Silver Diammine Fluoride is an affordable, simple, non-invasive treatment to arrest dentinal caries in children and adolescents. Silver Diammine Fluoride is an important public health measure in developing areas as it requires minimal equipment and non-dental operators can be trained to apply SDF in areas where access to dental treatment is difficult (56). A 38% SDF solution, applied twice a year, has demonstrated the ability to arrest caries in dentine, preventing the development of pain and infection. The silver ion interacts with the central bacterial mechanisms, killing bacteria and preventing biofilm formation. Precipitation of the ion onto dentine reduces its permeability and encourages dentine sclerosis. Good patient compliance is often reported, however the patients and patents can be deterred by the reported metallic taste and dark carious lesion staining. To prevent staining, potassium iodide (KI) can be applied, reacting with free silver ions forming a creamy white silver iodide. No change in bacterial inhibition has been noted with KI however further studies are required. Tooth sensitivity and pulpal irritation have also been noted (56-58). More research is required before SDF can be widely recommended.

Chlorhexidine

Chlorhexidine is available as a mouthrinse, gel, paste, spray, swab, chewing gum and varnish. Chlorhexidine is an antimicrobial, aimed to reduce the level of cariogenic bacteria in the oral environment and can adsorb onto the pellicle, mucous membranes, tooth surfaces and into biofilm (59). Unfortunately, due to its taste, it is not always tolerated well by children and adolescents. Although one systematic review cautiously concluded that professional application of chlorhexidine varnish can moderately reduce caries if applied every 3-4 months (60), there is currently insufficient evidence regarding its ability to prevent caries in children and adolescents (59, 61-63).

Diet and sugar substitutes

The link between the frequent consumption of fermentable carbohydrates and caries development has long been established. However, the widespread use of topical fluorides and the introduction of water fluoridation have reduced the importance of dietary modification, in comparison to caries management before fluoride (64). In low caries risk children and adolescents with regular fluoride exposure, plaque removal and appropriate saliva function, dietary modification has a mild to moderate effect on caries development. In high caries risk children, with little or no fluoride exposure, diet remains the major aetiological factor (64). Parents should be counselled on establishing good dietary habits, restricting sugar-containing food consumption to less than five times per day (14, 64).

The use of sugar substitutes (xylitol, sorbitol, mannitol, aspartame) are promoted to reduce the frequency of sugars in the diet. Most of the research relates to xylitol, a wood-derived sugar alcohol that has been reported to interfere with bacterial function and is available in the form of sweets, lozenges and chewing gum. Xylitol is effective in caries reduction when delivered daily in wipes for infants and toddlers (65). Concerns have developed in regards to dental erosion if xylitol is delivered in conjunction with acidic flavouring (66). Although further research is required, promising results demonstrate reduction of smooth surface carious lesion progression and development.

Resin Infiltration

Many of the above non-operative intervention strategies rely on individual patient compliance. Resin infiltration is an alternative therapy to arrest the progression of the non-cavitated carious lesion in a high risk individual. After selected surface etching with 15% hydrochloric acid (HCL) the area is rinsed and dried. 95% ethanol is applied and air dried and the low viscosity resin can penetrate into the porosities of the subsurface lesion (67, 68). The reduction or removal of the intact carious lesion surface layer by HLC etching and subsequent insufficient infiltration is hypothesised to facilitate the progression of the carious lesion. Therefore careful surface selection, strict monitoring and motivating the patient on non-operative intervention strategies are indicated (68). Both resin infiltration and sealing with adhesive are useful techniques to help prevent the progression of non-cavitated carious lesions extending up to the DEJ or just into the dentine.

Pit and Fissure Sealants (FS) and Preventive Resin Restorations (PRR)

Fissure sealants are effective in the prevention of occlusal caries in permanent molars (69). The use of FS can be extended to incipient carious lesions, root surfaces and hypomineralised tooth structure in both the primary and permanent dentition (70). After 15 years in a single study, 31% of sealed surfaces developed caries compared to 83% of unsealed surfaces. Naturally, further caries prevention can occur if lost or partially lost sealants can be repaired at regular recalls (71). The PRR combines the use of a filled resin in a minimally excavated cavity followed by fissure sealing non-carious remaining fissures with an unfiled resin to minimise cavity size and protect remaining tooth structure (72).

Minimally Invasive Restorative procedures

Early minimal intervention practices focused on accurate caries diagnosis and risk assessment as part of treatment planning, followed by minimal operative management of cavitated lesions. The latter focused on minimally invasive cavity preparations and promoted the removal of all infected carious tooth structure. Although many of these surgical principals remain important, the core principals of MID have evolved to focus on changing the ecologic balance in the cavity and the biofilm. This allows the clinician to be less invasive with early carious lesions and conserve tissue in deeper carious lesions.

Cavity preparation and restoration

MID traditionally dictates cavity preparation should be limited to the extent of the lesion with a smooth

finishing surface and removal of all unsupported enamel margins (11). The removal of all infected carious tissue has long been the standard of care. More recently, conservative caries management has demonstrated severing the nutrient supply to the carious lesion, with a well placed, sealed and monitored restoration can shift the ecology of the lesion and arrest the carious progression. However, to what degree carious tissue must be removed and in which clinical situations this is suitable is yet to be determined (73).

The use of a glass ionomer cement (GIC) restoration to avoid iatrogenic pulp exposure in deep carious lesions close to the pulp is advantageous. A GIC restoration is placed after partial caries removal (gaining peripheral cleanliness), avoiding the area close to the pulp. Vital dentine will remineralise allowing tertiary dentine to be formed if the seal is maintained. On re-entry, the dentine is mostly hard beneath the restoration and pulp exposure is avoided (7). A single step procedure with (without re-entry) has demonstrated higher success rates. Both methods seal the bacteria within the cavity and demonstrate the biofilm and external substrate are key to the progression of caries in the cavity. Reduction in caries activity and remineralisation of dentine has further been demonstrated under well placed and maintained fissure sealants. It is still unclear how much carious tooth structure can be left under these restorations and how this will affect bonding of the restoration (73).

When removing carious tooth structure, identifying the change from infected dentine to affected dentine is difficult. The optimal amount of dentine to remove is thus ambiguous, and affects quantification for epidemiological studies (11). Infected carious lesions have been demonstrated to fluoresce red when excited by QLF, and this technology is available commercially (74). Hard tissue laser and air abrasion methods for caries removal are not widely used and struggle to remove softened carious tissue (75). Chemo-mechanical removal of softened carious dentine stains the organic matrix which is less mineralised. This can result in false positive staining of sound dentine at the DEJ and less mineralised dentine near the dental pulp and is no longer indicated as a minimally invasive caries removal aid (76).

Hall Technique (HT)

The preformed metal crown (PMC) is preferred over large multi-surface intra-coronal restorations in the primary dentition. The HT advocates the placement of a PMC, without local anaesthesia, tooth reduction and caries removal (debris removal is advised). It is indicated in symptomless primary teeth with small lesions according to strict exclusion criteria. Although further well controlled comparative studies are required before it can be widely recommended, the HT proposes a simple and less invasive technique in caries management for primary teeth which can also be used in non-clinical settings (14, 77).

Atraumatic Restorative Technique

Using hand instruments to remove carious tissue, a GIC restoration can be placed providing a chemical bond and fluoride release. This provides management opportunities for non-clinical settings, however success rates of two surface restorations are very poor (78, 79).

Repair of Restorations

An alternative to total replacement of a failed restoration is repair and may be used for localised small defects or in cases where total replacement will compromise tooth function in the future (80).

Repair is advantageous as it may not require local anaesthesia, it may have a reduced treatment time and reduced cost for the patient, preserving tooth structure and reducing stress on the pulp (80-82). There is currently limited long term evidence on the longevity of repaired restorations although a recent Cochrane review published "the survival rate at 2 year follow-up is good" (81). Without any randomized controlled trials to compare replaced and repaired restorations the decision is based on the clinician's clinical experience, the patients' circumstances and preferences (81).

Conclusion

The concept of MID has progressed with the development of new technologies to enhance detection and diagnosis and intervention of the carious process. Caries risk assessment and management, early detection, minimal intervention and regular monitoring is vital for modern dental practice.

References

1. Hale KJ. Oral health risk assessment timing and establishment of the dental home. Pediatrics. 2003 May;111:1113-6.
2. Featherstone JD. The science and practice of caries prevention. Journal of the American Dental Association. 2000;13:887-99.
3. Kidd EA, Fejerskov O. What Constitutes Dental Caries? Histopathology of carious enamel and dentine related to the action of cariogenic biofilms. Journal of Dental Research. 2004;83:C35-C8.
4. Ruby J, Goldner M. Nature of symbiosis in oral disease. Journal of Dental Research. 2007 ;86:8-11.
5. Olsen I. Review Article: New principles in ecological regulation - features from the oral cavity. Microbial Ecology in Health and Disease. 2006;18:26-31.
6. Nyvad B, Crielaard W, Mira A, Takahashi N, Beighton D. Dental caries from a molecular microbiological perspective. Caries Research. 2013;47:89-102.
7. Ericson D. The concept of minimally invasive dentistry. Dental Update. 2007;34:9-10.
8. Reeh ES, Messer H, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. Journal of Endodontics. 1989;15:512-6.
9. Standlee JP, Collard EW, Caputo AA. Dentinal defects caused by some twist drills and retentive pins. The Journal of Prosthetic Dentistry. 1970;24:185-92.
10. Braly BV, Maxwell EH. Potential for tooth fracture in restorative dentistry. Journal of Prosthetic Denistry. 1981;45:411-4.
11. Mount G. Minimal Intervention in Dentistry: How should a cavity be prepared? Journal of Minimum Intervention in Dentistry. 2012;5:7-10.
12. White JM, Eakle WS. Rationale and treatment approach in minimally invasive dentistry. Journal of American Dental Association. 2000;131:13S-9S.
13. Alves LS, Fontanella V, Damo AC, Ferreira de Oliveira E, Maltz M. Qualitative and quantitative radiographic assessment of sealed carious dentin: a 10-year prospective study. Oral Surgery Oral Medicine Oral Pathololgy Oral Radiology Endodontics. 2010;109:135-41.
14. Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, Eden E. Minimal intervention dentistry for managing dental caries - a review: report of a FDI task group. International Dental Journal. 2012;62:223-43.
15. Keyes PH. Present and future measures for dental caries control. Journal of the American Dental Association. 1969;79:1395-404.
16. Nishimura M, Rodis.O, Kariya.N, Matsumura S. Caries-risk assessment in early childhood using caries activity test. Pediatric Dental Journal: International Journal of Japanese Society of Pediatric Dentistry. 2011;21:116-22.
17. Kagihara LE, Niederhauser VP, Stark M. Assessment, management, and prevention of early childhood caries. Journal of the American Academy of Nurse Practitioners. 2009;21:1-10.

18. Mejia GC, Amarasena N, Ha DH, Roberts-Thomson KF, Ellershaw AC. Child Dental Health Survey Australia 2007: 30 year trends in child oral health. (Canberra), Australian Institue of Health and Welfare, Dental statistics and research series no 60. 2012;Cat. no. DEN 217.
19. Morou-Bermudez E, Billings RJ, Burne RA, Elias-Boneta A. Caries risk pyramid: a practical biological approach to caries management by risk assessment. Puerto Rico Health Sciences Journal. 2011;30:165-6.
20. Featherstone JD, Domejean-Orliaguet S, Jenson L, Wolff M, Young DA. Caries risk assessment in practice for age 6 through adult. Journal of the Californian Dental Association. 2007;35:703-7, 10-3.
21. Ramos-Gomez FJ, Crall J, Gansky SA, Slayton RL, Featherstone JD. Caries risk assessment appropriate for the age 1 visit (infants and toddlers). Journal of the Californian Dental Association. 2007;35:687-702.
22. Bratthall D, Petersson GH. Cariogram-a multifactorial risk assessment model for a multifactorial disease. Community Dentistry and Oral Epidemiology. 2005;33:256-64.
23. Stamm JW, Disney JA, Graves RC, Bohannan HM, Abernathy JR. The University of North Carolina caries risk assessment study. I: Rationale and content. Journal of Public Health Dentistry. 1988;48:225-32.
24. Alaluusua S, Malmivirta R. Early plaque accumulation-a sign for caries risk in young children. Community Dentistry and Oral Epidemiology. 1994;22:273-6.
25. Twetman S, Fontana M, Featherstone JD. Risk assessment – can we achieve a consensus? Community Dentistry and Oral Epidemiology. 2013;41:e64-e70.
26. Malmo University (Sweden), Cariogram - Download. [Internet] [cited 2013 May 4] Available from: http://www.mah.se/fakulteter-och-omraden/Odontologiska-fakulteten/Avdelning-och-kansli/Cariologi/Cariogram/.
27. Twetman S, Fontana M. Patient caries risk assessment. Monographs in Oral Science. 2009;21:91-101.
28. Fontana M, Zero DT. Assessing patients' caries risk. Journal of the American Dental Association. 2006;137:1231-9.
29. International Caries Detection and Assessment System Coordinating Committee, Rationale and Evidence for the International Caries Detection and Assessment System (ICDAS II) 2012, [Internet] [updated 23/4/12, cited 2013 May 4]; Available from: http://www.dundee.ac.uk/dhsru/docs/ICDASII_Rationale_Evidence_110906.doc.
30. Carounanidy U, Sathyanarayanan R. Dental caries: A complete changeover (Part II)-Changeover in the diagnosis and prognosis. Journal of Conservative Dentistry. 2009;12:87-100.
31. Hintze H, Wenzel A, Danielsen B, Nyvad B. Reliability of visual examination, fibre-optic transillumination, and bite-wing radiography, and reproducibility of direct visual examination following tooth separation for the identification of cavitated carious lesions in contacting approximal surfaces. Caries Research. 1998;32:204-9.
32. Arnold WH, Gaengler P, Kalkutschke L. Three-dimensional reconstruction of approximal subsurface caries lesions in deciduous molars. Clinical Oral Investigations. 1998;2:174-9.
33. Kühnisch J, Dietz W, Stösser L, Hickel R, Heinrich-Weltzien R. Effects of dental probing on occlusal surfaces-a scanning electron microscopy evaluation. Caries Research. 2007;41:43-8.
34. WHO. Oral Health Surveys, Basic Methods. Geneva. 1997;WHO (4th Edition).
35. Fisher J, Glick M. A new model for caries classification and management: the FDI World Dental Federation caries matrix. Journal of the American Dental Association. 2012;143:546-51.
36. Forgie AH, Pine CM, Pitts NB. The use of magnification in a preventive approach to caries detection. Quintessence International. 2002 ;33:13-6.
37. Chawla N. Can new methods improve the detection of proximal carious lesions in primary molars? [thesis] Melbourne: The University of Melbourne; 2009.
38. Whaites E. Essentials of Dental Radiography and Radiology. Third Edition ed: Elsevier Limited; 1992.
39. Haak R, Wicht MJ. Grey-scale reversed radiographic display in the detection of approximal caries. Journal of Dentistry. 2005;33:65-71.
40. Braga MM, Mendes FM, Ekstrand KR. Detection activity assessment and diagnosis of dental caries lesions. Dental Clinics of North America. 2010;54:479-93.
41. Peers A, Hill EJ, Mitropoulos CM, Holloway PJ. Validity and reproducibility of clinical examination, fibre-optic transillumination, and bite-wing radiology for the diagnosis of small approximal carious lesions: an in vitro study. Caries Research. 2009;27:307-11
42. Farah RA, Drummond BK, Swain MV, Williams S. Relationship between laser fluorescence and enamel hypomineralisation. Journal of Dentistry. 2008;36:915-21.
43. Lussi A, Francescut P. Performance of conventional and new methods for the detection of occlusal caries in deciduous teeth. Caries Research. 2003;37:2-7.
44. Duruturk L, Çiftçi A, Baharo□lu S, Öztuna D. Clinical evaluation of DIAGNOdent in detection of occlusal caries in newly erupted noncavitated first permanent molars in caries-active children. Operative Dentistry. 2011;36:348-55.
45. Braun A, Beisel C, Brede O. Laser fluorescence of dentin caries covered with a novel nano-filled sealant. Lasers in medical science. 2013;28:133-8.
46. BV IDC. Inspektor Dental Care User Manual 2004 Contract No.: Doc: 1604.01.19.01 Rev. 01.
47. al-Khateeb S, ten Cate JM, Angmar-Månsson B, de Josselin de Jong E, Sundstrom G, Exterkate RA, Oliveby A. Quantification of formation and remineralization of artificial enamel lesions with a new portable fluorescence device. Advances in Dental Research. 1997;11:502-6.
48. de Josselin de Jong E, Higham SM, Smith PW, van Daelen CJ, van der Veen MH. Quantified light-induced fluorescence, review of a diagnostic tool in prevention of oral disease. Journal of Applied Physics. 2009:1-7.
49. Benson PE, Pender N, Higham SM. Quantifying enamel demineralization from teeth with orthodontic brackets-a comparison of two methods. Part 2: validity. European Journal of Orthodontics. 2003;25:159-65.
50. Featherstone JD. Prevention and reversal of dental caries: role of low level fluoride. Community Dentistry and Oral Epidemiology. 1999;27:31-40.
51. Inaba D, Kawasaki K, Iijima Y, Taguchi N, Hayashida H, Yoshikawa T, Furugen R, Fukumoto E, Nishiyama T, Tanaka K, Takagi O. Enamel fluoride uptake from mouthrinse solutions with different NaF concentrations. Community Dentistry and Oral Epidemiology. 2002;30:248-53.
52. Walsh T, Worthington HV, Glenny AM, Appelbe P, Marinho VC, Shi X. Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. Cochrane Database Systematic Reviews. 2010, Issue 1. Art. No.: CD007868. DOI: 10.1002/14651858.pub.2
53. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride varnishes for preventing dental caries in children and adolescents. Cochrane Database Systematic Reviews. 2002, Issue 1. Art. No.: CD002279. DOI:10.1002/14651858.CD002279.
54. Mount G, Hume W. Preservation and restoration of tooth structure. Barcelona, Spain: Mosby International Ltd.; 1998.
55. Bailey DL, Adams GG, Tsao CE, Hyslop A, Escobar K, Manton DJ, Reynolds EC, Morgan MV. Regression of post-orthodontic lesions by a remineralizing cream. Journal of Dental Research. 2009;88:1148-53.
56. Peng JY, Botelho MG, Matinlinna JP. Silver compounds used in dentistry for caries management: A review. Journal of Dentistry. 2012;40:531-41.
57. Rosenblatt A, Stamford TCM, Niederman R. Silver diamine fluoride: a caries "silver-fluoride bullet". Journal of Dental Research. 2009;88:116-25.
58. Yee R, Holmgren C, Mulder J, Lama D, Walker D, van Palenstein Helderman W. Efficacy of silver diamine fluoride for arresting caries treatment. Journal of Dental Research. 2009;88:644-7.

59. James P, Parnell C, Whelton H. The caries-preventive effect of chlorhexidine varnish in children and adolescents: a systematic review. Caries Research 2010;44:333-40.
60. Zhang Q, van Palenstein Helderman WH, van't Hof MA, Truin GJ. Chlorhexidine varnish for preventing dental caries in children, adolescents and young adults: a systematic review. European Journal of Oral Sciences. 2006;114:449-55.
61. Anderson MH. A review of the efficacy of chlorhexidine on dental caries and the caries infection. Journal of the Californian Dental Association. 2003;31:211-4.
62. Rethman MP, Beltran-Aguilar ED, Billings RJ, Burne RA, Clark M, Donly KJ, Hujoel PP, Katz BP, Milgrom P, Sohn W, Stamm JW, Watson G, Wolff M, Wright JT, Zero D, Aravamudhan K, Frantsve-Hawly J, Meyer DM. Nonfluoride caries-preventive agents: executive summary of evidence-based clinical recommendations. Journal of the American Dental Association. 2011;142:1065-71.
63. Ribeiro LG, Hashizume LN, Maltz M. The effect of different formulations of chlorhexidine in reducing levels of mutans streptococci in the oral cavity: A systematic review of the literature. Journal of Dentistry. 2007;35:359-70.
64. Burt BA, Pai S. Sugar consumption and caries risk: a systematic review. Journal of Dental Education. 2001;65:1017-23.
65. Zhan L, Cheng J, Chang P, Ngo M, Denbesten PK, Hoover CI, Featherstone JD. Effects of xylitol wipes on cariogenic bacteria and caries in young children. Journal of Dental Research 2012 ;91:S85-S90.
66. Antonio AG, Pierro VS, Maia LC. Caries preventive effects of xylitol-based candies and lozenges: a systematic review. Journal of Public Health Dentistry. 2011;71:117-24.
67. Paris S, Meyer-Lueckel H, Kielbassa AM. Resin infiltration of natural caries lesions. Journal of Dental Research 2007;86:662-6.
68. Martignon S, Ekstrand KR, Gomez J, Lara JS, Cortes A. Infiltrating/Sealing Proximal Caries Lesions A 3-year Randomized Clinical Trial. Journal of Dental Research. 2012;91:288-98.
69. Ahovuo-Saloranta A, Hiiri A, Nordblad A, Worthington H, Makela M. Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents. Cochrane Database Systematic Review. 2004 Issue 4. Art. No.: CD001830. DOI:10.1002/14651858.CD001830.pub3.
70. Manton DJ, Messer LB. Pit and fissure sealants: another major cornerstone in preventive dentistry. Australian Dental Journal. 1995;40:22-9.
71. Simonsen RJ. Retention and effectiveness of dental sealant after 15 years. Journal of the American Dental Association. 1991;122:34-42.
72. McConnachie I. The preventive resin restoration: a conservative alternative. Journal of the Canadian Dental Association. 1992;58:197-200.
73. Schwendicke F, Dorfer CE, Paris S. Incomplete caries removal: A systematic review and meta-analysis. Journal of Dental Research. 2013;92:306-14.
74. de Josselin de Jong, Higham SM, Smith PW, van Daelen CJ, van der Veen MH. Quantified light-induced fluorescence, review of a diagnostic tool in prevention of oral disease. Journal of Applied Physics. 2009;105:1-7.
75. Murdoch-Kinch CA, McLean ME. Minimally invasive dentistry. Journal of the American Dental Association. 2003;134:87-95.
76. Yip HK, Stevenson AG, Beeley JA. The specificity of caries detector dyes in cavity preparation. British Dental Journal. 1994;176:417-21.
77. Innes NP, Evans DJ, Stirrups DR. Sealing caries in primary molars: randomized control trial, 5-year results. Journal of Dental Research. 2011;90:1405-10.
78. Chan T. Atraumatic restorative treatment: an alternative for pre-cooperative children. Journal of the Michigan Dental Association. 2007;89:42-4.
79. Cole BO, Welbury RR. The atraumatic restorative treatment (ART) technique: does it have a place in everyday practice? Dental Update. 2000;27:22-3.
80. Welbury.R, Duggal.M, Hosey.M, editors. Paediatric Dentistry. 3rd Edition ed: Oxford University Press; 2005.
81. Sharif MO, Catleugh M, Merry A, Tickle M, Dunne SM, Brunton P, Aggarwal VR. Replacement versus repair of defective restorations in adults: resin composite. Cochrane Database Systematic Reviews. 2010, Issue 2. Art. No.: CD005971. DOI:10.1002/14651858.CD005971.pub2.
82. Hickel R, Brushaver K, Ilie N. Repair of restorations - Criteria for decision making and clinical recommendations. Dental Materials. 2012;29:28-50.

Printed with permission by the author.

2013 Louise Brearley-Messer Postgraduate Essay

A severely anxious 10 year old presents for his first dental exam with a sore tooth. Discuss the anxiety reducing techniques and management of this patient

Dr Debra Clare Elsby
Paediatric Dentistry Program, Melbourne Dental School
University of Melbourne

Introduction

It is highly unusual in today's society for a child to reach the age of 10 without some form of dental experience, be it from regular reviews from the family dentist, the school dental service, from dental trauma requiring treatment or pain from dental infection. All of these scenarios may be anxiety evoking for a child who is experiencing dental care for the first time. It is the job of the paediatric dentist to understand the feelings of the child and to manage their experience in a positive manner allowing the child to gain confidence in the dental setting.

Causes of Dental Anxiety

Dental anxiety is encountered commonly when treating children. Incidence varies from 3- 20% depending upon population studied and anxiety measures used.[1-3] It is a complex, typically multifactorial condition that can act as a barrier to good oral health.[2-6] Rachman's three pathways to fear development describes conditioning, modelling and vicarious learning.[1, 5-7]

Conditioning involves direct experience such as previous unpleasant dental visits. This has the largest effect on the child's anxiety state, especially after multiple negative experiences at a young age, particularly extraction.[5, 8-10] Conversely, children with previous restorative experience demonstrate significantly less anxiety than those with no dental experience, and when asked to recall pain, it is usually deemed more comfortable than expected.[10-12] This pathway could not be the reason behind this 10 year-olds anxiety as this is his first dental visit.

Modelling is an indirect factor where anxiety has been witnessed and/or acquired, although this does not correlate strongly with the child's dental anxiety, it can have influence.[5, 8-10, 13] Again, our child has had no previous dental experience so it is unlikely that modelling is a cause of his anxiety.

Lastly, vicarious learning is when a child is informed of the 'horrors of the dentist' from peers or family. This only appears to play a minor role in anxiety development but may be the cause of the patient's anxiety in this scenario.[5, 9, 10]

General factors include low SES, psychological trait anxiety, general behaviour problems and temperament.[5, 6, 8-11, 14] Generally, shy, withdrawn or moody children are less likely to co-operate for dental care, this coupled with the fear of the unknown may play a role in our child's distress. Conscious sedation is also less successful in these personality groups.[15] Children suffering high levels of general anxiety, possibly our 10 year-old, often respond negatively to new experiences and their recall of unpleasant experiences are exaggerated making behaviour management more difficult.[6]

Older females are more likely to describe themselves as dentally anxious compared to males, although clinically males demonstrate similar anxiety, likely due to the perception of how 'men' ought to act.[5, 9, 10, 16]

Sporadic, symptomatic attenders tend to display more dental anxiety, possibly as extraction is likely at each visit.[8, 9]

The behaviour of the parent also affects the child; anxious parents are more likely to over-estimate their child's anxiety and act accordingly.[17, 18] The mother-child dyad involves three distinct groups of mother-child relationships. In the competent dyad, the mother behaves consistently, reassuring the child; in the aggressive dyad, the mother is inconsistent with sustained emotional distance from the child; and finally the anxious mother becomes intrusive, authoritarian and distant with little empathy.[19] The latter two groups present difficulties as the child craves parental attention; displayed by poor behaviour in the dental setting dependant upon dental experience and psychological factors.[19] This can be gauged at as our patient enters the surgery by assessing the non-verbal communication between parent and child. If this is evident, it may be beneficial to treat the child without the parent present, especially if the parent experiences dental anxiety, or if their parenting style is counter-productive to behaviour management. This decision should be taken after consideration of the child's ability to cope without the parent in the room. If our 10-year-old enters the surgery grasping the parent, it may be beneficial for the parent to remain in the surgery, at least until the child has relaxed. An alternative is having a non-anxious adult accompany the child. It is important for the parent to understand their role in the dental appointment, usually that of a silent observer.[8]

The dentist's empathy also affects the child's dental anxiety.[5, 20] The key for future attendance and co-operation, therefore, is the development of trust between clinician, child and family.[8, 15]

Causes of Pain in a 10 year-old

- Dental Caries

It has been well documented that oral health has an impact on a child's general health; and the most common worldwide oral health problem in children is dental caries.[21] Although prevalence has decreased over the last 30 years, the caries burden is increasingly skewed towards a minority of children, namely those of low socioeconomic status (SES) coupled with behavioural and lifestyle factors.[21-25] Recently dental caries among Australian children has risen, with young teenagers grouped into those at highest risk. Children aged 6-10 years old displaying the highest caries scores have between six and ten times more caries than the entire age bracket.[25] Therefore dental caries is most likely the cause of this anxious 10 year-olds pain.

- Dental Trauma

A quarter of school aged children and a third of all adults incur an injury to the permanent dentition.[26] There is little data regarding the prevalence of traumatic

dental injuries in Australia. A prospective longitudinal study revealed an incidence of 1.7/100 per year in children aged 6 – 12 years.[27] Most Australian studies have revealed a significantly higher prevalence of trauma in the permanent dentition in males than females, attributed to their differing behaviours.[28, 29] Most traumatic injuries (71 -92%) occur before the age of 19, with peaks in the age brackets of 2-4 years and 8-10 years, particularly in boys. Therefore, trauma could also be the cause of pain in our 10 year old boy.[26, 30]

- Others

Other causes of dental pain include enamel breakdown due to molar hypomineralisation, dentine hypersensitivity, exfoliating primary teeth or erupting permanent teeth.[31]

First Dental Visit

On initial presentation, obtaining a thorough dental and medical history is mandatory. In the case of a 10-year-old boy, the clinician should seek information about why this is the child's first dental visit. Information can be gained from both caregiver and child, thus including the child from the outset, establishing initial rapport.[8] The child should talk freely without interruption to allow understanding of feelings and observation of non-verbal cues such as eye-contact.[19] The aim is to put the child at ease using a friendly tone, smile and age-appropriate language. If he is not comfortable talking, he should remain included in the conversation to allow the potential for 'warming up'.[8]

The nature, onset, duration and type of pain, as well as exacerbating or relieving factors should be documented. If the child is particularly anxious, he could provide this information over the telephone via the caregiver prior to the appointment, or in a consultation room furnished appropriately for children.[32] This allows discussion of anxiety-managing strategies including home-based preparation encompassing a team-approach in child management.[8, 33, 34]

The dental history should be discussed, including the preventive regime adopted. A systematic medical history covers hospital admissions and previous operations; enquiry including all body systems, immunisation status, regular medications and the presence of allergies. Pregnancy, family and social histories also include important information; however, should not seem intrusive. Information includes number of siblings and their dental experience, school attended and performance in class, as well as interests and hobbies. These can be used to interact with the child, helping to build on initial rapport.[35]

The extra-oral examination should commence at first introduction, including the presence of swelling, asymmetries or redness, the appearance and movement of the eyes, mouth opening and swallowing ability. A general appraisal of physical condition, gait and interaction with caregiver and staff may allow assessment of co-operation potential. This should begin prior to the child sitting in the dental chair, often a behavioural hurdle, so behaviour management should commence here.

Behaviour Management Techniques

- Communication

Encouraging methods are often better received as opposed to demands for co-operation from parent or clinician.[20] A 10 year-old child with normal development should respond well to adult reasoning, expectations and explanation.[15] Where possible, the child should be given control, enhancing comfort and reducing anxiety. For example, "Would you like to jump onto the chair from this side or that side?" Here, the child has the choice of direction but there is no debate on whether he sits or not.

Dentists treating anxious children tend to communicate more regularly providing reassurance, feedback and using physical contact such as a shoulder pat, which has been shown to improve co-operation.[36] It is, however, important that the caregiver is comfortable with this, to ensure no perception of inappropriate physical contact. Reassurance alone may appear as denial or ignoring the child's feelings. This is detrimental to fear reduction, as is coaxing, coercing and humiliation.[4, 20]

The acronym PRIDE should be adopted which includes:

'Praise' – labelled praises being more effective than non-labelled. An example being, "You're doing a fantastic job of keeping still for that x-ray."

'Reflection' involves repetition and embellishment of what a child has told you.

'Inquire' can be used throughout the visit and involves asking open-ended questions, encouraging more information than a simple statement of reply.

'Describe' is similar to praise in that a positive behaviour from the child is described and reinforced.

'Enthusiasm' is very important when treating children, the clinician can afford to be more light-hearted, entertaining and fun than that generally required when treating adults.[35]

- Tell-Show-Do

Our patient has not had experience with dental radiographs which, after the clinical examination, are often a necessity to aid definitive diagnosis. Tell-show-do is a technique favoured by dentists, patients and parents that may be useful here if, like our patient, the child has not had a radiograph previously.[37] The child is informed of what is going to happen using appropriate language; the procedure is then demonstrated to the child, using a mouth model, a video or enlisting a parent or sibling to model the technique (without capturing the image); the procedure is then performed on the patient without deviation from the explanation and demonstration.[3] This works well in children who use modelling as a coping strategy, however, those children who use blunting in an attempt to deny the stressful aspects of the dental appointment will not wish to be given detailed information.[8, 20]

- Distraction Therapy

Adequate local anaesthesia is essential to avoid a painful dental procedure but this is often the most anxiety-provoking procedure.[38] Injection-related anxiety usually reduces with age, unless severe, and is not necessarily related to overall dental anxiety development.[39] Allowing appropriate time for topical anaesthesia to become effective is always necessary and distraction therapy is useful here. Traditionally this involves the child concentrating on something else such as wiggling their fingers or toes, raising legs or arms on command, allowing the caregiver to read a story, listening to music or watching a movie using specialised safety glasses.[8, 40] There is conflicting evidence on the value of this technique on anxiety reduction, however, children were positive in their responses after use and requested it on subsequent visits.[35, 41] The child is given control by choosing the book, song or movie.[14]

An adaption to distraction is contingent distraction where good behaviour is

rewarded with a distraction such as a movie. If disruptive behaviour occurs, the distraction is removed until behaviour improves.[8, 42]

- Contingent Escape

The use of non-verbal communication such as raising the left hand if a break is required during treatment can be helpful in gaining the child's trust, however it may also allow the child to continually escape from the procedure.[32, 42] A way to manage this is using contingent escape where instead of raising a hand to stop treatment, by remaining still and quiet for a defined period, the child earns a pause in treatment. Any disruptive behaviour will lengthen the period required before the break.[33 42]

- Pain Management

The slow administration of local anaesthetic, kept out of the patient's eye-line, using a soft, hypnotic voice and guided imagery can be beneficial for effective delivery as an alternative to distraction.[43] The use of 'the wand®', an electronic device that administers local anaesthetic slowly and looks less invasive than the traditional dental syringe can also be of benefit, especially for our patient who has not experienced local anaesthetic before but may have an idea of what a dental syringe looks like.[44] For local infiltrations, considering articaine with its short onset time, increased depth and consistent duration of anaesthesia, supplemented with intra-ligamentary and, or intra-papillary injection can reduce discomfort.[45]

- Relative Analgesia

When behaviour management techniques supplemented by painless delivery of local anaesthetic are not adequate to allow a pleasant dental experience, modification to the child's state of awareness may be required. This should be discussed in advance with the caregiver and, in most cases, the child to reduce the sense of the unknown. Nitrous oxide (N2O) is most commonly used, is safe and simple, easily titrated to an appropriate individual level and readily reversed due to its relative insolubility in the blood.[15] Contraindications to use are a blocked nose, as nasal breathing is required; as a gas in the body, N2O can accumulate in an enclosed system if the child has had recent eye surgery, suffers from otitis media or bowel obstructions.[15] Otherwise, relative contraindications include severe psychiatric disorders, obstructive pulmonary disease, chronic obstructive airway disease, communication problems, acute respiratory tract infection and uncooperative patients.[35] Nitrous oxide can be effective in reducing anxiety in patients that endeavour to co-operate. Tell-show-do with the use of the nasal mask can gain co-operation. Allowing the patient to choose the scent of mask and taking the mask home to practice positioning can help desensitise the child. Alternatively, a trial visit where minimal or no treatment is undertaken may assist in confidence building, desensitisation and assessing the concentration required for adequate sedation at the subsequent appointment.[35] However, due to our child's pain, relief of this will be required at this visit.

N20 enhances the child's imagination and susceptibility to suggestion.[15] Other advantages include amnesic effects; reduction in pain perception, fatigue and natural hyperactivity.[15] The lightest possible level allowing adequate co-operation for treatment completion should be administered.[46]

- Conscious Sedation

Any form of conscious sedation, excluding N20, requires clinicians in Australia to undergo further training. Each practitioner must complete a Graduate Diploma in Conscious Sedation from the University of Sydney and also attend The Centre for Resuscitation Education and Simulation Training course yearly; in addition, the dental assistant involved in sedation is also required to attend annual advanced life-support courses.[47]

- Oral Sedation

The use of oral sedation, such as the midazolam, chloral hydrate, hydroxyzine, promethazine or ketamine, is not recommended in children over the age of 6 years as they may become disinhibited and difficult to control, ruling out this form of sedation for our 10 year-old. Other disadvantages include the inability to titrate the drug adequately and difficulty with reversal.[35] A Cochrane review found weak evidence that the use of oral midazolam, at a dose of 0.5 - 0.75 mg/kg is an effective sedative agent for children.[48] This is becoming more popular in the UK and is widely accepted in the USA as an alternative to general anaesthetic.[49]

- Intravenous Sedation

Intravenous sedation can be useful in children. Requirements include a qualified medical nurse and a suitably qualified sedationist or anaesthetist; monitoring is mandatory, as is adequate resuscitation equipment, recovery facilities and reversal drugs. The main disadvantage is its mode of delivery. Most anxious children are anxious about needles; this can be combatted by using N2O for cannula placement.[49] Benefits of IV sedation include high success rates, rapid onset, short duration, it can be titrated limiting the risk of respiratory depression and rapid reversal with flumazenil is possible.[49, 50] Indications include children of 8 years or older, ASA I/II, co-operation for cannula insertion and parents equipped to provide post-operative care. The type of procedure appropriate includes those of approximately 30 minutes duration, such as minor oral surgery and 1-2 quadrants of operative dentistry.[35] This form of sedation may be adequate for our child if all the requirements as above are in place.

- General Anaesthetic

If all of these options have been exhausted or are unavailable, the remaining option for the treatment of this anxious 10 year-old is under a general anaesthetic (GA). It should always be explained to the caregiver that this mode of treatment involves risk and all other forms of behaviour management should be considered in the first instance. Morbidity highly outweighs mortality, but the risk of serious complication does exist.[48, 49] In a healthy 10 year-old, attempts should be made to avoid a GA unless there is a severe facial cellulitis or facial trauma with poor co-operation. Dentists are more likely to refer younger children with more advanced dental caries or severe dental trauma for a general anaesthetic rather than older patients, unless all other treatment options are exhausted.[18] A treatment plan must be in place to limit future GA and focus on desensitisation in the dental setting. Appropriate prevention, be that of caries recurrence or mouthguard provision to aid reduction of dental trauma should be included in the plan. The child should be appropriately fasted and the waiting time prior to the surgery should be kept to a minimum. Allowing a parents' presence at induction is often comforting. Ideally they should also be present in recovery when the child is awake and stable.[35]

Considerations for the initial visit

The examination and special tests allow the clinician to reach a diagnosis. Further behaviour management techniques necessary will depend on the cause of

the pain, the treatment need, and the child's co-operative ability. All possible treatment options and forms of behaviour management should be presented to the primary caregiver including the option of no treatment where appropriate, for example if the pain is coming from an exfoliating primary tooth, quite likely in a 10 year-old. When there is infection, pain or reduced function, treatment is necessary. If the parent declines any treatment, even after explanation and advice over perceived barriers to care such as transport or cost, the dentist has a legal duty to report the parent for neglect to the appropriate child protection services.[51]

Potential benefits, risks or problems associated with each option, as well as cost, should be appropriately explained in lay-terms to allow complete and informed consent.[52]

Depending on the anxiety level of this 10 year old boy, and the complexity of the procedure required to treat the pain, simple behavioural techniques such as slow, deep breathing and sequential relaxation of all muscles may be all that is required to complete treatment.[32]

If co-operation for comprehensive care is not achievable, depending upon the diagnosis, a temporary dressing may alleviate discomfort. Allowing the child to hold a hand mirror and watch the clinician temporise the tooth may help reduce anxiety.[32] If a temporary restoration is inappropriate for the diagnosis, the child should be prescribed adequate pain relief, for example paracetamol 15mg/kg/dose 4-6 hourly and/or ibuprofen 5-10mg/kg/dose 6-8 hourly. If there is an obvious infection, appropriate antibiotics should also be prescribed until comprehensive care can be undertaken.[35]

Each appointment should always end on a high, reinforcing progress, even if this is minor. Small rewards such as stickers or badges may also encourage the child to co-operate a little more each visit.[8, 32]

Conclusion

As discussed, the main aims for the treatment of this child are anxiety reduction, pain elimination and provision of sound advice for the family to maintain adequate oral health long term. Experiences gained at the dentist early in life will remain into adulthood and can greatly influence whether they become regular or sporadic attenders.[53] It is the duty of the paediatric dentist to strive for the former.

References

1. Lee C-Y, Chang Y-Y, Huang S-T. The clinically related predictors of dental fear in Taiwanese children. International Journal of Paediatric Dentistry 2008;18:415-422.
2. Holmes RD, Girdler NM. A study to assess the validity of clinical judgement in determining paediatric dental anxiety and related outcomes of management. International Journal of Paediatric Dentistry 2005;15:169-176.
3. Diercke K, Ollinger I, Bermejo JL, Stucke K, Lux CJ, Brunner M. Dental fear in children and adolescents: a comparison of forms of anxiety management practised by general and paediatric dentists. International Journal of Paediatric Dentistry 2012;22:60-67.
4. ter Horst G, Prins P, Veerkamp J, Verhey H. Interactions between dentists and anxious child patients: a behavioral analysis. Community Dentistry and Oral Epidemiology 1987;15:249-252.
5. Townend E, Dimigen G, Fung D. A clinical study of child dental anxiety. Behaviour Research and Therapy 2000;38:31-46.
6. Locker D, Liddell A, Dempster L, Shapiro D. Age of Onset of Dental Anxiety. Journal of Dental Research 1999;78:790-796.
7. Rachman S. The conditioning theory of fearacquisition: A critical examination. Behaviour Research and Therapy 1977;15:375-387.
8. Campbell C SF, Busuttil-Naudi A, Chadwick B. Non-pharmacological behaviour management. www.bspd.co.uk, 2011:Clinical Guideline.
9. Tickle M, Jones C, Buchannan K, Milsom KM, Blinkhorn AS, Humphris GM. A prospective study of dental anxiety in a cohort of children followed from 5 to 9 years of age. International Journal of Paediatric Dentistry 2009;19:225-232.
10. Nicolas E, Bessadet M, Collado V, Carrasco P, Rogerleroi V, Hennequin M. Factors affecting dental fear in French children aged 5–12 years. International Journal of Paediatric Dentistry 2010;20:366-373.
11. Brown DF, Wright FC, McMurray NE. Psychological and behavioral factors associated with dental anxiety in children. Journal of Behavioral Medicine 1986;9:213-218.
12. Huq AH, Lindsay SJE, Roberts JF. Children's expectations and recollections of discomfort associated with dental treatment. International Journal of Paediatric Dentistry 1992;2:11-16.
13. Krikken J, van Wijk A, ten Cate J, Veerkamp J. Child dental anxiety, parental rearing style and referral status of children. Community Dental Health 2012;29:289.
14. Sandeep N, Bailwad A, Nirmala S, Sivakumar N. Effectiveness of music distraction in the management of anxious pediatric dental patients. Annals and essences of dentistry 2010;2:1-5.
15. Wilson S. Management of child patient behavior: Quality of care, fear and anxiety, and the child patient. Journal of Endodontics 2013;39:S73-S77.
16. Raadal M, Milgrom P, Weinstein P, Mancl L, Cauce A. The prevalence of dental anxiety in children from low-income families and its relationship to personality traits. Journal of Dental Research 1995;74:1439-1443.
17. Krikken JB, Van Wijk AJ, Ten Cate JM, Veerkamp JSJ. Measuring dental fear using the CFSS-DS. Do children and parents agree? International Journal of Paediatric Dentistry 2013;23:94-100.
18. Carson P, Freeman R. Dental caries, age and anxiety: factors influencing sedation choice for children attending for emergency dental care. Community Dentistry and Oral Epidemiology 2001;29:30-36.
19. Freeman R. A fearful child attends: a psychoanalytic explanation of children's responses to dental treatment. International Journal of Paediatric Dentistry 2007;17:407-418.
20. Alwin N, Murray JJ, Niven N. The effect of children's dental anxiety on the behaviour of a dentist. International Journal of Paediatric Dentistry 1994;4:19-24.
21. Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century–the approach of the WHO Global Oral Health Programme. Community Dentistry and oral epidemiology 2003;31:3-24.
22. Kruger E, Dyson K, Tennant M. Hospitalization of Western Australian children for oral health related conditions: a 5–8 year follow up. Australian dental journal 2006;51:231-236.
23. Tennant M, Namjosh D, Silva D, Codde J. Oral health and hospitalization in Western Australian children. Australian Dental Journal 2000;45:204-207.
24. Do LG, Spencer AJ, Slade GD, Ha DH, Roberts-Thomson KF, Liu P. Trend of income-related inequality of child oral health in Australia. Journal of Dental Research 2010;89:959-964.
25. Armfield JM. High caries children in Australia: A 'tail' of caries distribution. Australian Dental Journal 2005;50:204-206.
26. Glendor U. Epidemiology of traumatic dental injuries – a 12 year review of the literature. Dental Traumatology 2008;24:603-611.
27. Stockwell AJ. Incidence of dental trauma in the Western Australian School Dental Service. Community Dentistry and Oral Epidemiology 1988;16:294-298.
28. Wright G, Bell A, McGlashan G, Vincent C, Welbury RR. Dentoalveolar trauma in Glasgow: an audit of mechanism and injury. Dental Traumatology 2007;23:226-231.

29. Tham RCA, Cassell E, Calache H. Traumatic orodental injuries and the development of an orodental injury surveillance system: a pilot study in Victoria, Australia. Dental Traumatology 2009;25:103-109.
30. Andreasen JQ, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. International Journal of Oral Surgery 1972;1:235-239.
31. Mitchell L, Mitchell DA, MacCaul L. Oxford handbook of clinical dentistry: Oxford University Press, 2009:Pages.
32. Wright FAC, Giebartowski JE, McMurray NE. A national survey of dentists' management of children with anxiety or behaviour problems. Australian Dental Journal 1991;36:378-383.
33. Hernandez P, Ikkanda Z. Applied behavior analysis Behavior management of children with autism spectrum disorders in dental environments. The Journal of the American Dental Association 2011;142:281-287.
34. Adair SM. Behavior management conference Panel I reportrationale for behavior management techniques in pediatric dentistry. Pediatric Dentistry 2004;26:167-170.
35. Cameron AC, Widmer RP. Handbook of pediatric dentistry. Third edn: Mosby, 2008:Pages.
36. Prins P, Veerkamp J, ter Horst G, de Jong A, Tan L. Behavior of dentists and child patients during treatment. Community Dentistry and Oral Epidemiology 1987;15:253-257.
37. Buchanan H, Niven N. Self-report treatment techniques used by dentists to treat dentally anxious children: a preliminary investigation. International Journal of Paediatric Dentistry 2003;13:9-12.
38. Ram D, Peretz B. Administering local anaesthesia to paediatric dental patients–current status and prospects for the future. International Journal of Paediatric Dentistry 2002;12:80-89.
39. Majstorovic M, Veerkamp JS. Relationship between needle phobia and dental anxiety. Journal of Dentistry for Children 2004;71:201-205.
40. Jindal R, Kaur R. Can We Tune Our Pediatric Patients? International Journal of Clinical Pediatric Dentistry 2011;4:186-189.
41. Aitken JC, Wilson S, Coury D, Moursi A. The effect of music distraction on pain, anxiety and behavior in pediatric dental patients. Pediatric dentistry 2002;24:114-118.
42. Kuhn BR, Allen KD. Expanding child behavior management technology in pediatric dentistry: A behavioral science perspective. Pediatric Dentistry 1994;16:13-13.
43. Peretz B, Bimstein E. The use of imagery suggestions during administration of local anesthetic in pediatric dental patients. ASDC Journal of Dentistry for Children 2000;67:263.
44. Allen KD, Kotil D, Larzelere R, Hutfless S, Beiraghi S. Comparison of a computerized anesthesia device with a traditional syringe in preschool children. Pediatric Dentistry 2002;24:315-320.
45. Malamed SF, Gagnon S, Leblanc D. A comparison between articaine HCl and lidocaine HCl in pediatric dental patients. Pediatric Dentistry 2000;22:307-311.
46. Rothman D. Sedation of the pediatric patient. Journal of the California Dental Association 2013;41:603-611.
47. Australia DBo. Registration standard for endorsement in relation to conscious sedation. http://www.dentalboard.gov.au/Registration/Conscious-Sedation.aspx, 2010.
48. Lourenco-Matharu L, Ashley PF, Furness S. Sedation of children undergoing dental treatment. Cochrane Database Syst Rev 2012;3.
49. Averley P, Lane I, Sykes J, Girdler N, Steen N, Bond S. An RCT pilot study to test the effects of intravenous midazolam as a conscious sedation technique for anxious children requiring dental treatment – an alternative to general anaesthesia. British Dental Journal 2004;197:553-558.
50. Collado V, Faulks D, Nicolas E, Hennequin M. Conscious Sedation Procedures Using Intravenous Midazolam for Dental Care in Patients with Different Cognitive Profiles: A Prospective Study of Effectiveness and Safety. PloS one 2013;8:e71240.
51. Kellogg N. Oral and dental aspects of child abuse and neglect. Pediatrics 2005;116:1565-1568.
52. Allen KD, Hodges ED, Knudsen SK. Comparing four methods to inform parents about child behavior management: how to inform for consent. Pediatric Dentistry 1995;17:180-180.
53. Venham LL, Gaulin-Kremer E, Munster E, Bengston-Audia D, Cohan J. Interval rating scales for children's dental anxiety and uncooperative behavior. Pediatric Dentistry 1980;2:195-202.

Eulogy Alistair Devlin

John Winters

Hello. My name is John Winters, and I like all of you here am proud to call myself a friend and colleague of Alistair Devlin. I would like to thank Helen for the honour of her invitation to speak today, and to acknowledge her loss and pain, even while we are all grieving for Alistair. We are gathered here though, not to grieve, but to remember and celebrate his extraordinary life. Alistair was a real gem of a man, with so many facets, all of which shone so brightly.

Alistair was a natural entertainer, a talented musician, a comedian with a wickedly irreverent sense of humour, a deliciously biting wit, and a refreshing disdain for the "politically correct". Many of us have enjoyed his impromptu concerts whenever there was an unguarded piano in the room. Several of my friends have spontaneously recalled a glorious evening cruising across Lake Wakatipu on the TSS Earnslaw out of Queenstown NZ, when Alastair livened up the journey with just such a show. I'm sure we can all picture him sitting there at the piano with his cheeky, infectious, and radiant smile.

Alistair was also a keen sportsman who for decades enjoyed playing veteran's hockey with his team, as much as a social game of tennis. He was doing what he loved, right up till the end.

He was a committed professional in his field of dentistry, and while running his own private practice he still found time to have an active role in the Dental Department at Princess Margaret Hospital, where I first met him as an undergraduate dental student more than 30 years ago. He was actively involved with the University of Western Australia Dental School where he loved his role as a teacher and mentor for the undergraduate and postgraduate students. Even in retirement, he still continued to work on with his students. He recently commented, "At the moment, I am enjoying this role to such an extent, I would be happy to keep at it for a few (more) years."

He was an organiser and pillar of support for his professional world, playing an active role in the development of the Alumni Society, the Endodontic society, and the Australian and New Zealand Society of Paediatric Dentistry (or ANZSPD for short).

In our disposable society, Alistair was not a man with "a short span of attention". He served in the role of Secretary/ Manager to ANZSPD for nearly 40 years. In his own words to the current Federal President of ANZSPD, John Sheahan, Alistair wrote …

"No need to worry, because the succession plan for ANZSPD is something that has exercised my brain from time to time. The funny thing is that on this occasion, I will have to do it. I say that because when the WA Branch of the Australian Society of Dentistry for Children was established in 1974, I was the Foundation Secretary. 38 years on and I am still the Secretary. It is fair to say I don't have a good record when it comes to succession planning!

His own words!

Alistair was a humble man, focussed on service, rather than self-aggrandisement. I heard a colleague ask why Alistair never put himself forward to be President of ANZSPD. The answer was that he was more that happy just to run the organisation! He knew that the role of President was simply to divert attention away from where the real decisions were made!

He was not only an extraordinary organiser, he was someone who could successfully delegate, and many of us have experienced that "tap on the shoulder". Not only would he delegate though, he would also follow through to make sure that the job got done, and done properly. He was an amazing negotiator and could diplomatically manage to lubricate a room full of massive egos so that objectives were achieved and ruffled feathers would be smoothed. We all agreed that Alistair should be our manager for life, and he was! I presented Alistair with the award of honorary life membership of ANZSPD in recognition of his extraordinary long service way back in 2007 at the Broome Congress, in recognition of his selfless and untiring efforts to the Society. Never has there been a more deserving recipient!

Despite this enormous professional commitment, Alistair was a man who seemed to have found the secret of balance in his life. His enormously generous heart could warmly embrace his friends, his colleagues, and his students, but he was always a family man, and in his quiet moments I noticed that he loved nothing more than to talk about his family, his children, and particularly in more recent years, the utter delight he took from spending time with his grandchildren.

Alistair, the musician could always find the appropriate song for an occasion. I'm sure he would appreciate Paul Simon's song "You can call me Al" which posed the question.

"Who'll be my role model, now that my role model has gone?"

YOU CAN CALL ME AL – Paul Simon

A man walks down the street
He says why am I short of attention
Got a short little span of attention
And wo my nights are so long
Where's my wife and family
What if I die here
Who'll be my role-model
Now that my role-model is
Gone Gone

Alistair Devlin being awarded his Honorary Life Membership of the Australian and New Zealand Society of Paediatric Dentistry

Federal President's Report

by John M Sheahan

As I write this report, Members in ANZSPD's Australian Branches are struggling to understand the complexity and bureaucracy of the Child Dental Benefits Scheme (CDBS), a AUD$2.9 billion scheme which commenced operation on 1st January, 2014.

During the planning stages of the scheme, ANZSPD presented a comprehensive submission to the Department of Health and Ageing. While any initiative aimed at trying to reduce oral health inequalities and improve access to dental care for children and adolescents is to be applauded, ANZSPD's submission sought to bring to the attention of the Australian Government that a scheme which defines eligibility solely on income status, systematically discriminates against those children who have the greatest unmet oral health needs.

In particular, the CDBS does nothing to target basic dental care for high risk groups: patients with cleft lip and/or palate, patients with congenital anomalies of the teeth, patients with special healthcare or behavioural needs, patients in rural and remote areas or patients who are indigenous Australians. In the submission, ANZSPD was also critical of the CDBS because it failed to offer a higher benefit to patients who, because of their significant medical histories and/or behavioural issues, need a dental specialist to manage their basic dental care. An enhanced scale of fees such as this would have been comparable to the enhanced benefit that patients receive from Medicare for the same service when they attend our specialist medical colleagues rather than a general medical practitioner.

Moreover, the CDBS has done nothing to improve access to basic dental restorative treatment completed under general anaesthesia for the children of the working poor who require it, because the scheme specifically prevents the payment of a benefit when basic dental treatment is performed under general anaesthesia. The now closed Enhanced Primary Care (EPC) scheme was poorly implemented. This resulted in many dentists inadvertently working outside the scheme's intended guidelines.

It is sad to report the Australian Government has not learnt from the mistakes made during the implementation of the EPC and has once again failed to provide practitioners with adequate and timely education about a new scheme.

ANZSPD's submission about the CDBS was only one of many submissions, made by the Society on behalf of our nations' infants, children and adolescents since the last meeting of Federal Council. While I have taken responsibility for compiling and submitting these reports on behalf of ANZSPD, they could not have been produced at such a high standard were it not for the significant input supplied by ANZSPD's broader membership. In particular, I would like to acknowledge the outstanding contributions made by Dr Karen Kan, Associate Professor Nicky Kilpatrick, Professor David Manton and Dr John Winters.

The Society has also played an active role in shaping the future oral health of our young people by supporting my attendance at Australia's National Oral Health Plan 2014-23 Workshop and the participation of Dr Soni Stephen, who acted as my proxy, at the Health Workforce 2025 – Oral Health Workshop. The Society is most grateful to Soni for taking time away from his family to attend on its behalf. I would also like to thank Dr Karen Kan for attending the ADA Affiliates Breakfast as my proxy during the ADA Congress in Melbourne. It has been reported to me by senior ADA officials that Karen represented the Society's interests exceptionally well in her oral presentation to the assembled delegates. Another ADA Affiliates Meeting is scheduled to occur in Sydney in May, 2014. I invite input from Members regarding suggested agenda items in advance of the meeting. This is another opportunity for the views of ANZSPD to be heard by leaders in the broader dental profession and we need to make the most of it.

I am hoping that the avalanche of requests for ANZSPD to make submissions about Australian issues slows in 2014. On the other hand, I will certainly not complain if I have to write a submission or two to the New Zealand Government or its agencies on behalf of ANZSPD because I am yet to write one.

All of ANZSPD's Federal Councillors have actively contributed to the Council's deliberations via email since its last meeting which coincided with the ADA Congress in Melbourne. This form of instant communication has allowed the Society to address many issues as they have arisen, leaving only the more complex or less urgent ones to be discussed at the next formal meeting of Federal Council on 27th February, 2014. I am most grateful to the Federal Councillors for their wisdom and diligent attention to the duties of their office.

The 2014 RK Hall Lecture Series was a great success with two hundred delegates from across Australia and New Zealand meeting in Melbourne on 28th February and 1st March. This meeting was proudly sponsored by Colgate, the Society's major corporate partner. Without Colgate's financial assistance, a meeting of this size and quality would be impossible to present for Members. Two eminent and entertaining international keynote speakers were invited to be the 2014 RK Hall Lecturers. Associate Professor Michael Casas from the Hospital for Sick Children in Toronto, Canada and Professor Svante Twetman from the University of Copenhagen, Denmark shared their expertise with the audience on a number of topics: pulp therapy for the primary dentition and the immature permanent dentition, dental trauma, cariology and the effectiveness of preventive strategies, including novel approaches to caries prevention. To the Society's friends at Colgate, under the leadership of Dr Susan Cartwright, I offer ANZSPD's sincere thanks and look forward to a continuing long and productive professional relationship. While I, myself, was directly and heavily involved with the organization of the 2014 RK Hall Lecture Series, the meeting could not have been planned so effectively without the contribution of all of the Members of the Organizing

Committee. I would like to thank each of them for their efforts. In particular, I would like to thank Dr Karen Kan, the President of the Victorian Branch, for her outstanding contribution and the leadership of her team, and Dr Evelyn Yeung, Branch Secretary, also for her outstanding contribution to the organization of the lecture series.

As all Members of the Society should be aware by now, Dr Alistair Devlin, our esteemed Federal Secretary/Manager and Honorary Life Member, passed away unexpectedly in March, 2013. His death has left a huge void within the Society and his absence is sorely missed. Not only was Alistair Federal Secretary/Manager for over 20 years, he was the Western Australian Branch Secretary for over 38 years. He will long be remembered for his welcoming smile, good humour, his role as a mentor and his unmatched legacy of dedicated service to ANZSPD. He truly was the glue that held together the Society's geographically disparate Branches. To honour his enormous contribution to both ANZSPD Inc and the Western Australian Branch, a short Memorial Service will be conducted during the 2014 RK Hall Lecture Series. We are delighted that his widow, Mrs Helen Devlin, and their son, Mr Richard Devlin, accepted ANZSPD's invitation and were in attendance as the Society's guests. We trust that the Memorial Service was the catalyst for Members to celebrate Alistair's life and shared anecdotes in the way, I am sure, Alistair, himself, would have wanted.

ANZSPD is indeed fortunate that Dr Peter Gregory agreed to accept my invitation to become Federal Secretary/Manager, at least in an interim capacity following Alistair's passing. His presence in the role has allowed the Society to transition smoothly in what might otherwise have been a turbulent period in the Society's history. Under Peter's fine stewardship, ANZSPD has been able to continue to respond appropriately to its administrative responsibilities. I value Peter's systematic approach, analytical skills, experience and excellent communication skills, all of which have made it a delight to work with him. He has already achieved much during his relatively short tenure, and I sincerely hope that Peter will agree to remain ANZSPD's Federal Secretary/Manager, at least until the end of my term in office. Apart from Peter, I would also like to thank my colleagues who offered their support to me in the period shortly after Alistair's passing – the Society's Immediate Past President, Dr Kareen Mekertichian, President Elect, Dr Tim Johnston and Victorian Branch President, Dr Karen Kan.

This is only the third issue of Synopses to have been distributed during my Presidency. However, I am pleased to report that all Branches contributed Branch reports in the last issue. This was the first time that this has occurred for some years. Dr Tim Johnson is to be congratulated on doing such a great job editing Synopses on the Society's behalf, especially as a dearth of material has been available for publication. My only regret is that Tim has tendered his resignation and this issue will be the last he will edit.

Many of you will be aware that the ANZSPD website crashed last year. Since then the Federal Council has budgeted for the development of a revitalized website and Members will get their first glimpse of it during the 2014 RK Hall Lecture Series. I am most grateful to Dr John Winters who has coordinated its development on behalf of the Society. I am sure it has already taken many hours of work to get it to this stage and I thank him for his efforts.

On the international stage, I had the pleasure to represent ANZSPD at the 24th Congress of the International Association of Paediatric Dentistry (IAPD) in Seoul, South Korea in July, 2013. It was exciting to see so many Australasians contributing to the success of the meeting, not just as registrants but also as Member Society Delegates at the IAPD Council Meeting, Invited Speakers, Chairs of Sessions, and Research Scientists delivering their Oral or Poster Presentations. Of course, the Congress was supervised by Dr Eduado Alcaino, who stepped down as IAPD President at the Closing Ceremony after 2 years in office. At the same occasion, the IAPD flag was handed to Professor Richard Welbury, Chair of the 25th IAPD Congress, which is to be held in Glasgow, Scotland (1st-4th July, 2015)

It seems like I have become Federal President of ANZSPD at a time that is politically important in the Society's relatively short history. I trust that I will continue to receive the support of the general membership and Federal Council in forwarding the aims of the Society for the benefit of the infants, children and adolescents of Australia and New Zealand.

I wish you all good health and a safe and prosperous year in 2014.

Federal Secretary-Manager's Report

Peter Gregory

I must firstly admit that 12 months ago, I never envisaged that I would be writing this report as Secretary/Manager of ANZSPD (Inc.). The very sad circumstances of the passing of our beloved friend, colleague and previous Secretary/Manager, Alistair Devlin, in March 2013, necessitated the change.

Following the last Federal Council meeting which was held in Melbourne in April 2013, I was approached by the Federal President, Dr John Sheahan, to take on the position, at least in a transitional capacity, and of course immediately accepted the role. It has been an interesting but extremely challenging role as there was obviously no opportunity for a hand-over and picking up all of the threads of a Secretary/ Manager who had held the position for over 30 years had its own unique problems.

Never-the-less we got through.

I must firstly acknowledge the tremendous support that I have received from so many within and outside of the society. This obviously includes the President, Dr John Sheahan, the Federal Councillors and the Executive and Members of the various branches of ANZSPD (Inc.) around Australia and New Zealand.

I must also mention the significant assistance I received from Helen Devlin and her family in the difficult days that followed Alistair's passing.

2013 has been an unprecedented year for the number of requests made by outside organisations for information and reports. I congratulate Dr John Sheahan for taking on the overall responsibility of compiling and submitting these reports, but ably supported by so many of our members who contributed to these projects. Special mention here to Karen Kan, Nicky Kilpatrick, David Manton and John Winters.

In June 2013, the President represented our society at the 2013 IAPD Congress held in Seoul, Korea. From all reports, this was a very well organised and enjoyable experience for all who attended and we look forward to the next IAPD congress to be held in Glasgow, Scotland in 2015.

On a personal note I attended, on behalf of ANZSPD (Inc), The Health Workforce Australia 2025 workshops in Perth in March and October, 2013. These workshops were an interesting insight into the current dental workforce in Australia and projections of where the dental profession would be in 2025.

The main time consuming issues over the last 12 months were changing over the contact details of our organisation, changing signatures for bank accounts, chasing up branch treasurers for overdue subscriptions, and particularly dealing with the Australian Tax Office with issues pertaining to our Business Activity Statements, GST and our Colgate Sponsorship Contract. I am pleased to inform members that all of these tasks and issues have now been resolved.

In December, the results of the 2013 Louise Brearley-Messer Undergraduate and Postgraduate essays were announced. The winner of the Postgraduate Essay Prize was Dr Debra Elsby from the University of Melbourne. The winner of the Undergraduate Prize was Mr Joshua Ting from the University of Adelaide and second prize was awarded to Ms Shannon De Marie from the University of Western Australia. Special thank to our Judges, Drs Sally Hibbert and Erin Mahoney (Postgraduate) and Drs Chris Olsen and Soni Stephen (Undergraduate). We look forward to the publication of these essays in Synopses.

As I write this report, we are about to attend the RK Hall Lecture Series in Melbourne which promises to be a great event. The Victorian Branch of ANZSPD (Inc.) under the Presidency of Dr Karen Kan, together with her very hard working organising committee, must be congratulated for their enormous efforts in bringing this project to fruition.

I must acknowledge our major sponsor, Colgate, under the guidance of Susan Cartwright, which continues to be a great supporter of ANZSPD. We hope this partnership will continue a long time into the future.

I wish all members of our council, their families and friends a Happy Healthy and Prosperous 2014.

South Australia Branch News

Dr Wendy Cheung

Following from the success of ANZSPD SA's 2011 programme including the Uluru conference and well attended dinner meetings, 2012 was another strong year for membership.

The activities of the SA Branch in 2012 were centred on the dinner meetings, which were all very well attended. A/ Prof Sam Gue spoke about and illustrated "Syndromes with Dental Significance". Prof Jane Scott presented to us on "Early Childhood Feeding Practices and Oral Health", reviewing the evidence for any role of breastfeeding in the initiation of dental caries. The results of the NHMRC grant study that Prof Scott is carrying out in conjunction with the Australian Research Centre for Population Oral Health may add to the present limited evidence on the topic. Thanks to A/ Prof Sam Gue, Dr Michael Malandris, and Dr Manjara Packianathan, we were able to see some case studies and discuss management of oral trauma in children. Dr Ninna Estrella, a newly arrived paediatric dentist from the USA who is residing in Adelaide until 2016, finished our year with an intriguing presentation on her experiences from Michigan, where she worked as Clinical Assistant Professor at the University of Michigan, Ann Arbor as well as Director of Paediatric Dentistry Services at C.S. Mott Children's Hospital. We are also delighted with the contributions of the postgraduate students at all of our meetings.

It has been an outstanding success for us to have the involvement and interest of the undergraduate dentistry students in our meetings; we were told that ANZSPD is one of only a few study groups or dental societies in South Australia that welcome students and they have found the dinner meetings very welcoming and their interest in Paediatric Dentistry has been enhanced. We also welcome members to bring along guests to the meetings and we have had the companies of dental therapists, oral health therapists, and postgraduate students in diet and nutrition.

In SA, we have an exciting program ahead of us in 2013 – on 5th March Ms Virginia Hill is speaking to us on "Oral and Speech Development"; 7th May Dr Damian Chan is giving a presentation on "Common Allergic Reactions in Childhood"; 6th August Ms Angela Coppi will talk about "Families Coping with Their Autistic Child"; and our meeting on 15th Oct will include various case presentations and discussion on "First Permanent Molars in Childhood – dealing with caries, hypomineralisation, impaction and other challenging situations". If you are interested in joining us at our meeting, please contact our secretary for more details.

The "Biennial" ANZPSD meeting will be held in Adelaide in 2015 (delayed due to the upcoming RK Hall tour being held in February/March, 2014). Suggestions and ideas are more than welcome. Preparations are already underway!

REFERENCES CONTINUED FROM PAGE 24...

Oral Health Behaviours, Attitudes and Diets of Dental Students Mid-training

Alice S. M. Whang and Louise Brearley Messer
Melbourne Dental School, University of Melbourne, Melbourne, Australia
Corresponding author:
Emeritus Professor Louise Brearley Messer AM
Melbourne Dental School, University of Melbourne, Victoria, Australia
ljbm@unimelb.edu.au

Abstract

Objective: Investigating oral health habit formation in dental students, this study compared self-reported behaviours and student attitudes mid-training in 2011 and 1997. ***Participants and methods:*** An anonymous questionnaire was distributed to 135 3rd and 4th year dental students in 2011 (91% response) and trends were compared with 91 3rd and 4th year students in 1997 (86%). In 2011, 87 students (64%) also completed a 7-day diet diary. ***Results:*** Almost all students tooth-brushed ≥2/day with fluoride toothpaste. Over time, significant increases occurred in flossing (p=0.0001), flossing 1-2/day (p=0.0005), and in current flossing technique use for the last 2 years (p=0.002). In 2011, significantly fewer students had been taught how to brush (p=0.008) and fewer used mouth-rinses (p=0.04); dental attendance 2-3/year increased (p=0.0001), and fewer attended only for a problem (p=0.01). Snacking, gum-chewing and smoking habits remained unchanged. Attitudes shifted over time, significantly increasing in strong agreement while decreasing in agreement that: 'healthy teeth and gums are a reflection of a healthy body' (p=0.0001; p=0.0001); 'regular dental attendance (is) important for my dental health' (p=0.0002; p=0.04); 'straight white teeth are important for my appearance' (p=0.03; p=0.009); and 'smoking could have an effect on my teeth or gums' (p=0.002; p=0.006). Despite acknowledging possible effects, at both time periods a few students still smoked (1997:2%; 2011:1%). In 2011, almost all students exceeded the Recommended Daily Intake (RDI) for the meat/fish/eggs/poultry group, but few (10-34%) met other RDIs. ***Conclusions:*** While favourable oral health habits appeared well-established in dental students in mid-training, health promotion remains necessary, particularly concerning smoking cessation and healthy dietary habits.

Introduction

Oral health promotion is paramount in the prevention of oral diseases.[1] Dental professionals are responsible for raising awareness and promoting oral health for individuals and the community.[2-4] Oral health behaviours, attitudes and diet of dental students may reflect the value of the dental school curriculum, and the way in which such responsibilities will be carried out in their role as future leaders of oral health.

The present study continues previous studies of 320 students in 1997 in all five years of the undergraduate dental course at the University of Melbourne, followed up in 2001.[5] Changes between course entry and completion were increases in: flossing frequency and recognition of flossing benefit; dental attendance; expectations of maintaining their dentition for life, and recognition of effects of smoking on their dentition.[5] Study of ten classes (1997, 2001-2009) of final year dental students showed well-established, favourable oral hygiene behaviours and attitudes; evidence suggested the positive changes reflected knowledge and experience gained with curricular progression. Despite many ceasing smoking, 5% still smoked.[5]

Aiming to further study development of oral health behaviours and attitudes of dental students, the present study investigated self-reports of students mid-training (3rd and 4th years), with three objectives, to: (1) examine oral health behaviours and attitudes of students in 2011; (2) compare these with oral health behaviours and attitudes of students reported in 1997; and (3) examine dietary habits of students in 2011.

Participants and methods

Conducted at the end of second semester 2011, dental students in mid-training (3rd and 4th years of a five-year undergraduate course) at the Melbourne Dental School, University of Melbourne, Australia, were surveyed using an anonymous questionnaire addressing their oral health behaviours and attitudes and a 7-day diet diary. Students were advised in advance about the study via their university e-mail. Questionnaires were distributed and collected immediately after completion at the end of a lecture. In 2011, diet diaries were then recorded over the following week when each student received $5.00 for its detailed completion (food, drinks) during and between meals for all seven days. Gender, height and weight were recorded but no other participant identification was collected. Data collection and storage accorded with required university protocols. Ethics approval was obtained (Human Research Ethics Committee, University of Melbourne) for the study; students consent was implied as given if they returned the questionnaire and diet diary.

As this study continued previous studies of oral health behaviours and attitudes of dental students, the same questionnaire (copy available from the corresponding author) was used.[5] This contained 18 questions on behaviours, 16 questions on habits, and 8 statements on attitudes and expectations. The questions addressed: tooth-brushing and flossing, use of mouth rinses and tooth-cleansing sticks/picks, dental attendance, snacking, gum chewing, sport drinks intake and smoking habits. Closed-ended questions (33) required one choice from three or four options. One open-ended question required naming the last snack consumed. The 8 statements (reported on a four-point Likert scale as: strongly agree, agree, disagree, strongly disagree) were: (1) 'Healthy teeth and gums are a reflection of a healthy body'; (2) 'I expect to keep most of my teeth for all my life'; (3) 'I expect my need for fillings in the

future will be minimal'; (4) 'I consider regular dental attendance is important for my dental health'; (5) 'I consider straight white teeth are important for my appearance'; (6) 'I consider tooth brushing important in keeping my teeth and gums healthy'; (7) 'I consider regular flossing to be an added benefit in maintaining healthy teeth and gums'; (8) 'I consider smoking could have an adverse effect on my teeth or gums'.

Statistical analysis

Questionnaire data were entered into Excel spreadsheets (Microsoft Corp., Seattle, Washington, USA). Distributions and behaviour-attitude associations were examined descriptively and with non-parametric statistics for 2x2 tables (Fisher Exact 2-tailed test; a=0.05). As multiple tests were not performed on each question, p values were not adjusted.[6] Responses of students in 2011 were compared with those of students in 1997.[5] Diet diaries (2011 only) were examined by both authors independently, classifying all entries into five food groups with discussion to agreement. Almost all diaries contained Asian dishes with a range of ingredients; these were classified into food groups based upon personal knowledge of Asian cooking of one author (ASMW) and from relevant websites.[7,8] Nutritional adequacy was examined using Recommended Daily Intakes (RDIs) of the National Health and Medical Research Council of Australia.[9]

Results

Distribution of students and questionnaire responses

In 1997, all 91 students in the 3rd and 4th year classes received the questionnaires (response rate: 86%); in 2011, 135 of 152 students in the 3rd and 4th year classes received the questionnaire and 123/135 (91%) provided usable responses. Since responses were distributed similarly for both classes in 1997 and in 2011, the year responses were combined.

Toothbrushing behaviour

Cross-sectional data on tooth brushing behaviour are shown ***(Table 1)***. Almost all students brushed with fluoride toothpaste, most brushing ≥2/day (79%, 87%). Fewer students in 2011 had been taught how to brush than in 1997 (76% vs 91%, p = 0.008), and most had been taught by dentists (67%, 68%). The increase in 2011 in those taught by dental hygienists or therapists (27% vs 14%) was not significant.

Flossing behaviour

Flossing behavior increased between 1997 and 2011 (69% vs 92%, p=0.0001, ***Table 1***). Although the decrease in flossing 1-2/week (54% vs 38%) between 1997 and 2011 was not significant, the increase in flossing 1-2/day was significant (46% vs 62%, p=0.0005). Similar proportions of students had been taught how to floss at both time periods (73%, 70%), mostly by dentists (81%, 82%); a few had been taught by dental hygienists or therapists (12%, 9%). More students in 2011 than in 1997 had used their current flossing technique for the last two years (52% vs 37%, p=0.002).

Use of mouth rinses and tooth cleansing sticks/picks

Between 1997 and 2011 mouth rinse use declined (31% vs 18%, p=0.04, ***Table 1***); fewer students rinsed 1-2/day (33%, 23%) while the proportion rinsing 1-2/week increased, but not significantly (67% vs 77%). Between 1997 and 2011 the use of tooth cleansing sticks/picks also declined (18% vs 10%), but not significantly.

Table 1: Oral Health Behaviours of Third and Fourth Year Dental Students (N=201) in 1997 and 2011.

Oral Health Behaviours	Distribution of Student Responses (n, valid %)		
	Total 1997 N=78)	Total 2011 (N=123)	Total responses (N=201)
Use Fl toothpaste	78 (100)	121 (99)	199 (99)
Brushing frequency: 1-2/week 1/day ≥2/day	 2 (2) 14 (18) 62 (79)	 1 (1) 15 (12) 105 (87)	 3 (1) 29 (14) 167 (84)
Taught how to brush	71 (91)	93 (76)	164 (82)
Taught to brush by: dentist hygienist/therapist relative	 52 (67) 10 (14) 9 (11)	 63 (68) 25 (27) 5 (5)	 115 (70) 35 (21) 14 (8)
Current technique used for: ≤12months last 2 years last 5 years last 10 years	 5 (6) 36 (46) 20 (26) 17 (22)	 11 (9) 44 (37) 25 (21) 38 (32)	 16 (8) 80 (41) 45 (23) 55 (28)
Floss teeth	54 (69)	114 (92)	168 (83)
Flossing frequency: 1-2/week 1-2/day	 29 (54) 25 (46)	 43 (38) 71 (62)	 72 (43) 96 (57)
Taught how to floss	57 (73)	86 (70)	143 (71)
Taught to floss by: dentist hygienist/therapist relative	 46 (81) 7 (12) 4 (7)	 71 (82) 8 (9) 7 (8)	 117 (82) 15 (10) 11 (8)
Current technique used for: ≤12 months last 2 years last 5 years last 10 years	 10 (18) 20 (37) 14 (26) 10 (18)	 17 (15) 59 (52) 24 (21) 13 (11)	 27 (16) 79 (47) 38 (23) 23 (14)
Use a mouth rinse	24 (31)	22 (18)	46 (23)
Rinsing frequency: 1-2/week 1-2/day	 16 (67) 8 (33)	 17 (77) 5 (23)	 33 (72) 13 (28)
Use tooth cleansing sticks/picks	14 (18)	12 (10)	26 (13)
Had a dental exam	77 (99)	120 (97)	197 (98)
Frequency of dental visits: 1/year 2-3/year only if problem	 47 (61) 9 (12) 21 (27)	 60 (50) 44 (37) 16 (13)	 107 (54) 53 (27) 37 (19)

Dental examination

Almost all students (99%, 97%) had received a dental examination ***(Table 1)***. Between 1997 and 2011, there was a decrease in the proportion of students attending a dentist 1/year (61% vs 50%), a decrease in those attending only if there was a problem (27% vs 13%, p=0.01), and an increase in those attending 2-3/year (12% vs 37%, p=0.0001).

Between-meal snacking, use of sports drinks and chewing gum and smoking habits

Most students (85%, 84%) snacked between meals ***(Table 2)***. While the proportion of those snacking ≤1/day decreased slightly between 1997 and 2011 (46% vs 40%), the proportion snacking 2-4/day showed a non-significant increase (46% vs 59%). Sports drink consumption decreased between 1997 and 2011 (31% vs 10%, p=0.0006), and intake ≤1/week increased

among consumers (87% vs 100%, p=0.02). The proportion of students chewing gum declined between 1997 and 2011 (76% vs 63%), with most chewing sugarless gum (93%, 97%), between meals (65%), to stimulate saliva and freshen breath (56%, 49%). The last snack consumed was classified post hoc as previously.[5] Snack choice frequencies were similar at both time periods and were combined. In decreasing order, snacks were: sweets, chocolates (32%); savories, chips, crackers (21%); fruit, vegetables, nuts, juices (19%); cakes, biscuits, muesli (16%); milk drinks, yoghurt, ice-cream (8%); breads, muffins (3%) (not tabulated). In all, six students ***(Table 2)*** reported currently smoking (frequency: 1/wk: 2, 2/ wk: 2, ≥3/day: 2; quantity: ≤5/day: 4, 5-20/day: 2; duration : ≤5 yrs: 5, 5 yrs: 1) (not tabulated).

Table 2: Habits of Third and Fourth Year Dental Students (N=201) in 1997 and 2011.

Habits	Distribution of Student Responses (n, valid %)		
	Total 1997 N=78)	Total 2011 (N=123)	Total responses (N=201)
Snack between meals	66 (85)	104 (84)	170 (84)
Snacking frequency: ≤1/day 2-4/day ≥5/day	 30 (46) 30 (46) 6 (8)	 42 (40) 61 (59) 1 (1)	 72 (43) 91 (54) 7 (3)
Drink sport drinks	24 (31)	12 (10)	36 (18)
Sports drink frequency: ≤1/week 2-4/day	 21 (87) 3 (12)	 12 (100) 0	 33 (92) 3 (8)
Chew gum	59 (76)	78 (63)	137 (68)
Chew sugarless gum	55 (93)	76 (97)	131 (96)
Time of chewing gum: between meals immediately after meals	 38 (65) 21 (35)	 51 (65) 27 (35)	 89 (65) 48 (35)
Reason for chewing gum: saliva, breath-freshening bored hungry, taste	 33 (56) 12 (20) 14 (24)	 38 (49) 25 (32) 15 (19)	 71 (52) 37 (27) 29 (21)
Currently smoke	3 (4)	3 (2)	6 (3)
Have ever smoked	10 (13)	13 (11)	23 (11)

Attitudes and expectations

Responses to the 8 statements of attitudes and expectations are shown ***(Table 3)***. A higher proportion of students in 2011 strongly agreed with Statement 1 ('Healthy teeth and gums are a reflection of a healthy body') than in 1997 (67% vs 23%, p=0.0001), associated with a decrease in the proportion in agreement (64% vs 32%, p=0.0001). Responses to Statement 2 ('I expect to keep most of my teeth for all my life') were similar for both cohorts, with 76% in both 1997 and 2011 in strong agreement and 21-22% in agreement. Compared with students in 1997, responses to Statement 3 in 2011 ('I expect that my need for fillings in the future will be minimal'), showed fewer in strong agreement (53% vs 62%), and more in agreement (41% vs 32%, p=0.03). The proportion of students in 2011 strongly agreeing with Statement 4 ('I consider regular dental attendance important for my dental health') was higher than in 1997 (61% vs 33%, p=0.0002), and the proportion of those in agreement was less (37% vs 51%, p=0.04). Student disagreement was less frequent in 2011 than in 1997 (2% vs 15%).

Table 3: Distribution of Attitudes and Expectations of Third and Fourth Year Dental Students (N=201) in 1997 and 2011.

Statements	Attitude or expectation	Distribution of Student Responses (n, valid %)		
		Total 1997 (N=78)	Total 2011 (N=123)	Statistical significance[a]
1. 'Healthy teeth and gums are a reflection of a healthy body.'	Strongly agree Agree Disagree Strongly disagree	18 (23) 50 (64) 9 (12) 1 (1)	82 (67) 39 (32) 2 (2) 0	p= 0.0001 p = 0.0001 – [b] –
2. 'I expect to keep most of my teeth for all my life.'	Strongly agree Agree Disagree Strongly disagree	59 (76) 16 (21) 3 (4) 0	93 (76) 27 (22) 3 (2) 0	p = 1.0 ns p = 1.0 ns – –
3. 'I expect that my need for fillings in the future will be minimal.'	Strongly agree Agree Disagree Strongly disagree	48 (62) 25 (32) 4 (5) 1 (1)	65 (53) 50 (41) 8 (7) 0	p = 0.24 ns p = 0.03 – –
4. 'I consider regular dental attendance important for my dental health.'	Strongly agree Agree Disagree Strongly disagree	26 (33) 40 (51) 12 (15) 0	75 (61) 45 (37) 3 (2) 0	p = 0.0002 p = 0.04 – –
5. 'I consider straight white teeth are important for my appearance.'	Strongly agree Agree Disagree Strongly disagree	20 (26) 52 (67) 5 (6) 1 (1)	50 (41) 58 (47) 15 (12) 0	p = 0.03 p = 0.009 – –
6. 'I consider tooth brushing to be important in keeping my teeth and gums healthy.'	Strongly agree Agree Disagree Strongly disagree	67 (86) 11 (14) 0 0	101 (82) 22 (18) 0 0	p= 0.56 ns p = 0.56 ns – –
7. 'I consider regular flossing to be an added benefit in maintaining healthy teeth and gums.'	Strongly agree Agree Disagree Strongly disagree	34 (44) 36 (46) 7 (9) 1 (1)	81 (66) 41 (33) 1 (1) 0	p = 0.0001 p = 0.07 ns – –
8. 'I consider smoking could have an effect on my teeth or gums.'	Strongly agree Agree Disagree Strongly disagree	54 (69) 21 (27) 2 (3) 1 (1)	108 (88) 12 (10) 3 (2) 0	p = 0.002 p = 0.006 – –

[a] *Fisher Exact test (2-tail), p<0.05*
[b] *Frequencies too small for statistical analysis*

Strong agreement with Statement 5 ('I consider straight white teeth are important for my appearance') was more favourable in 2011 than in 1997 (41% vs 26%, p=0.03), associated with a decrease in those recording agreement (47% vs 67%, p=0.009). The proportion of students in disagreement in 2011 exceeded that in 1997 (12% vs 6%). Responses to Statement 6 ('I consider tooth brushing to be important in keeping my teeth and gums healthy') were similar for both cohorts, with 82-86% strongly agreeing and 14-18% agreeing; no student disagreed. In 2011, strong agreement with Statement 7 ('I consider regular flossing to be an added benefit in maintaining healthy teeth and gums'), was more favourable than in 1997 (66% vs 44%, p = 0.0001), and fewer students disagreed (1% vs 9%). Strong agreement with Statement 8 ('I consider smoking could have an effect on my teeth or gums') was more favourable in 2011 than in 1997 (88% vs 69%, p=0.002), associated with a decline in those in agreement (10% vs 27%, p=0.006).

Table 4: Congruence of Behaviours and Attitudes of Third and Fourth Year Dental Students (N=201) in 1997 and 2011.

Distribution of Behaviours of Students		Distribution of Attitudes of Students (n, valid %)						
		Strongly agree		Agree		Disagree and/or Strongly disagree		Total Students (N=201)
		Total 1997 (N=78)	Total 2011 (N=123)	Total 1997 (N=78)	Total 2011 (N=123)	Total 1997 (N=78)	Total 2011 (N=123)	
Have had a dental examination	Statement 4: 'I consider regular dental attendance important for my dental health'							
	Yes	26 (33)	74 (60)	39 (50)	44 (36)	12 (15)	2 (1)	197 (98)
	No	0	1 (1)	1 (1)	2 (1)	0	0	4 (2)
	Total	26 (33)	75 (61)	40 (51)	46 (37)	12 (15)	2 (1)	201 (100)
Floss own teeth	Statement 7: 'I consider regular flossing to be an added benefit in maintaining healthy teeth and gums'							
	Yes	31 (40)	78 (63)	22 (28)	35 (28)	1 (1)	1 (1)	168 (83)
	No	3 (4)	3 (2)	14 (18)	6 (5)	7 (9)	0	33 (16)
	Total	34 (44)	81 (65)	36 (46)	41 (33)	8 (10)	1 (1)	201 (100)
Currently smoke	Statement 8: 'I consider smoking could have an effect on my teeth and gums'							
	Yes	0	0	3 (2)	2 (1)	0	1 (1)	6 (3)
	No	54 (69)	108 (88)	18 (15)	10 (8)	3 (4)	2 (1)	195 (97)
	Total	54 (69)	108 (88)	21 (17)	12 (9)	3 (4)	3 (4)	201 (100)

Congruence of behaviours and attitudes

Congruence of student behaviours and attitudes was examined for statements addressing dental attendance, flossing and smoking ***(Table 4)***. For Statement 4, all but one student (in 2011) strongly agreeing that 'regular dental attendance was important for (their) dental health' (1997: n=26, 2011: n=75) showed congruent behaviour (i.e., had a dental examination), with more students showing this congruence in 2011 than in 1997 (60% vs 33%, p=0.003). Of those agreeing with the statement (1997: n=40, 2011: n=46), three students showed incongruence (no dental examination); the difference between years was not significant (50% vs 36%). Despite disagreeing/strongly disagreeing, 14 students (1997: n=12, 2011: n=2) had a dental examination.

Of all students strongly agreeing with Statement 7 that: 'I consider regular flossing to be an added benefit in maintaining healthy teeth and gums' (1997: n=34, 2011: n=81), six showed incongruent behaviour (i.e., did not floss; ***Table 4***), and more showed congruent behavior in 2011 than in 1997 (63% vs 40%, p=0.001). Incongruence was more apparent amongst those in agreement (1997: n=36, 2011: n=41), where flossing was not a regular habit for 20 students (1997: n=14, 2011: n=6). But fewer students showed incongruence in 2011 than in 1997 (5% vs 18%, p=0.003). Seven of nine students (1997: n=8, 2011: n=1) disagreeing/strongly disagreeing on the benefits of flossing did not floss.

For Statement 8, all students strongly agreeing that 'smoking could have an effect on (their) teeth or gums' (1997: n=54, 2011: n=108) were congruent in their behavior (i.e., did not smoke; ***Table 4***), with more showing this congruence in 2011 than in 1997 (88% vs 69%, p=0.002). Of those in agreement (1997: n=21, 2011: n=12), five showed incongruent behaviour (smoked). Of those disagreeing/strongly disagreeing with the statement (1997: n=3, 2011: n=3), the behaviour of one student (in 2011) was congruent (smoked) and five showed incongruent behavior (did not smoke).

Distribution of diet diary responses

In total, 87/135 students (64%) provided usable diaries; 77% of these said their diary sampled a 'normal' week; 15 did not provide gender and 18 did not provide their height and weight. The mean (±SD) height, weight and BMI (kg/m^2) values for males (n=28) were: 1.8±0.1 m, 68.1±10.5kg, 21.7±2.4; for females (n=41): 1.6 ±0.1 m, 52.2 ±8.7kg, 20.7±2.6.

Dietary intakes

Assuming the diaries were an accurate and typical recording of intakes, many students consumed a diet of limited variety and ate their main meals at fast food outlets near the dental school. Fruit consumption (not tabulated) was low: ≥1 fruit serve/day was consumed by 40/87 (46%) students; ≥1 fruit serve was consumed on only 2-3 days of the week sampled by 24/87 (27%) students, and ≤1 serve in the week sampled was consumed by 17/87 (19%) students. Consumption of dairy products (not tabulated) was also low: ≥1 dairy serve/day was consumed by 43/87 (49%) students; ≥1 serve was consumed on only 2-3 days of the week sampled by 13/87 (15%), and ≤1 serve in the week sampled was consumed by 4/87 (5%) students.

The distribution of respondents' dietary intakes for food groups is shown ***(Table 5)***. The mean number of serves/day consumed by students met the RDI only for the food group containing lean meat, fish, eggs, poultry and nuts (RDI=1 serve/day), where the mean number of serves/day (2.7 ± 1.1) was more than twice the daily NHMRC recommendation;[9] 85/87 (98%) students met this RDI. For all other food groups, including fluid intake, the mean number of serves/day was below the respective RDI. In particular, the intake of vegetables and legumes (2.4 ± 1.3 serves/day) was approximately half the RDI (5 serves/day) for adults in this age group.[9] Few students met the RDIs for the groups comprising breads, cereals, pasta and rice (met by 27%); fruit (34%); vegetables and legumes (10%); milk, yoghurt and cheese (34%); and fluid intake (14%).

Table 5: Distribution of Mean Number of Serves of Food Groups per Day in Week Sampled and Students Consuming Recommended Dietary Intakes (RDIs) in 2011 (N=87).

Food Groups (Recommended Daily Intake, as serves)[a]	Distribution of Students (N = 87)	
	Mean (± SD) no. serves/day	No. students consuming RDI (n, valid %)
Breads, cereals, pasta, rice (RDI = 4)	3.3 (1.2)	24 (27)
Fruit (RDI = 2)	1.6 (1.0)	30 (34)
Vegetables, legumes (RDI = 5)	2.4 (1.3)	9 (10)
Lean meat, fish, eggs, poultry, nuts (RDI = 1)	2.7 (1.1)	85 (98)
Milk, yoghurt, cheese (RDI = 2)	1.3 (0.9)	30 (34)
Non-alcoholic fluids (RDI = 8) [b]	4.1 (2.6)	12 (14)

[a] *RDI = Recommended Daily Intake for Australian Adults aged 19-60 years (NHMRC 2005)*[9]

[b] *RDI = 8 glasses per day of non-alcoholic fluids*

Nutritional supplements (e.g., Iso Mass™, Up and Go™, Sustagen™, Hydralyte™) were used regularly by 15/87 (17%) students; 9/87(11%) consumed protein supplements, three students used vitamin and mineral supplements and two students used sports gels (not tabulated). These items were not placed in any food group. Fluid intakes were predominantly water followed by coffee and tea; alcohol intake was reported by 9/87 (11%) students (typically consumed 1-2/week).

Between-meal snacking was common practice for all 87 respondents. Comparing diary entries showed agreement with their previous questionnaire snack entries for 47/87 (54%) students. In decreasing order, snacks were: fruit, vegetables, nuts, juices (38%); cakes, biscuits, muesli (18%); milk, yoghurt, ice cream (18%); sweets, chocolates (14%); savories, chips, crackers (6%); breads, muffins (6%); soft drinks (0.6%) (not tabulated). Chocolate intake in the week sampled was high: 41/87 (47%) students snacked regularly on chocolate, with 30/87 (34%) having 1-4 chocolate snacks in the week sampled and 11/87 (13%) reporting 5-27 chocolate snacks (not tabulated). Of 31 students reporting on the questionnaire that their last snack was chocolate, 21/31 (68%) also recorded chocolate in their diary. Although gum chewing was reported by 77/123 (63%) students on the questionnaire, only 13/78 (17%) recorded gum-chewing in the week sampled.

Discussion

This cross-sectional study of oral health behaviours and attitudes of dental students in mid-training compared observations in 2011 and 1997, using the same questionnaire. The questionnaire was developed in 1997 and used at that time to study cross-sectionally and longitudinally the behaviours and attitudes of students at course entry and with progression through the five-year undergraduate curriculum in the Dental School (then known as the School of Dental Science), at the University of Melbourne.[5] Final year students in 2001-2009 were studied also.[5] The limitations of the present cross-sectional study conducted on small student sample sizes, and a non-response bias (1997: 14%; 2011: 19%), are acknowledged. The proportion of students receiving the questionnaire in 1997 (100%) was higher than in 2011 (89%), due to compulsory attendance at a lecture when the questionnaire was distributed in 1997. Of note, the financial reward for completing the diet diary in 2011 did not improve the response rate. Honest responses were encouraged by anonymity, by asking students not to discuss their responses during questionnaire completion, and by immediate questionnaire collection; this also reduced distraction from the lecture.

Favourable oral health behaviors were observed in students at both time periods, suggesting that this knowledge was developed during their clinical experience and training in dental school. Favourable behaviours appearing to increase significantly in frequency between 1997 and 2011 were: flossing, flossing 1/day, use of current flossing technique for last 2 years, and attending a dentist 2-3/year (also associated with a significant decrease in those attending only for a problem). Similar proportions of final year students from 1997 to 2009 also reported increasingly favourable behaviours.[5]

The importance of brushing with fluoride toothpaste is well established[2,10,11] and almost all students reported such behavior, in addition to demonstrating attitudinal congruence, as all students in both years strongly agreed or agreed with Statement 6 that 'tooth brushing (is) important in keeping my teeth and gums health.' The importance of flossing in maintaining a healthy periodontium is also well established.[12] The significant increase in flossing frequency between 1997 and 2011 was associated also with a significant decrease in students showing incongruent behavior concerning flossing over the time period, indicating less cognitive dissonance. These trends were supported by the significant increase in strong agreement in 2011 with attitudinal Statement 7: 'I consider regular flossing to be an added benefit in maintaining healthy teeth and gums', and also confirmed the increasing trend noted among final year students in 2001-2009 to floss 1-2/day (26% vs 64%).[5] Improved flossing behaviour was attributed to expanded teaching of periodontology between 1997 and 2011 at the Dental School. It is also likely that more students personally adopted favorable flossing behaviours as they advocated the habit to patients. In a public dental hospital, students encounter patients from long wait-lists, frequently presenting with periodontal disease and caries – witnessing the outcomes of neglected oral hygiene may also encourage students to improve their own oral health. Not surprising then, students in mid-training had used their current brushing and flossing techniques typically for the last two years, suggesting positive behavioural change since enrollment. Similarly, most final year students reported using their current brushing and flossing techniques for the last 5-10 years.[5]

Between 1997 and 2011, the roles of dental hygienists and therapists expanded in Australia, and particularly in private dental practices, with the development of a new code of practice in 2002. The present study showed a significant decrease in 2011 in the proportion of students taught how to brush, but an almost doubling of the proportion (14% to 27%) taught how to brush by dental hygienists or therapists between 1997 and 2011, indicative of increasing delegation of this role. The concurrent slight decrease in the teaching of flossing by dental hygienists or therapists (12% to 9%), suggests the need for strong advocacy of regular flossing in clinical practice.

The significant decrease in mouth-rinse usage between 1997 and 2011 (31% to 18%) may reflect increased awareness of

oral cancer related to the use of alcohol-containing mouth rinses[13] and media promotion.[14] Concurrently, final year students in 2001-2009 also decreased in use of mouth rinses (17%).[5] Declining use of tooth-cleansing sticks/picks between 1997 and 2011 (18% to 10%) by students mid-training also occurred amongst final year students in 2001-2009 (28% to 0), attributed to students' awareness of periodontal damage from such devices.[15]

Regular dental examination is essential for diagnosis, early treatment and prevention of dental disease[2] and students in 2011 appeared to be more cognizant of this than those in 1997. A significantly higher proportion of students in 2011 than in 1997 attended a dentist 2-3/year, and significantly fewer attended only for a problem. The trends were confirmed by the significantly higher proportion of students in 2011 than in 1997 who strongly agreed that 'regular dental attendance (is) important for my dental health', associated with a significant decrease in those agreeing with the statement. This indicates the positive impact of oral health promotion that had occurred, and may also reflect a general population trend in Australia, where an increase in dental visits per annum by dentate individuals occurred between these two time periods.[16]

Several other attitudes and expectations of students in 2011 differed significantly from those in 1997, with proportional shifts occurring between strong agreement and agreement to statements. In particular, increasing recognition of the contribution of oral health to general health[17] was apparent in the significant increase in strong agreement in 2011 over 1997 responses, and the corresponding decrease in agreement, to Statement 1 that 'healthy teeth and gums are a reflection of a healthy body'. This trend was observed also in the previous study of final year students over the period 2001-2009,[5] and was clearly maintained in 2011 among students in mid-training. Students appeared similarly optimistic about their own dentition at both time periods, with 76% strongly agreeing that they expected 'to keep most of (their) teeth for all (their) life', and 53-62% strongly agreeing their 'need for fillings in the future would be minimal'. The statement provoking the least agreement and the most disagreement pertained to 'straight white teeth are important for my appearance', indicating a polarization in attitudes over time. Students' views on the importance of 'straight white teeth' may have been influenced by their clinical training environments. Clinical training at the dental school occurs in a public dental hospital with recent expansion to include community health centres; in these clinics treatment is focused on preventing disease and retaining healthy dentitions rather than creating an aesthetically-pleasing smile for every patient.[18]

Between 1997 and 2011, major changes occurred in the Dental School. New academic and clinical specialist teaching staff were recruited in association with increased student intakes; a new and expanded clinical facility was built and occupied; clinical training in off-site rural and community health centres was introduced, and postgraduate programs in all specialties were expanded. Speculatively, the increase in favorable oral health behaviours and associated attitudes may reflect changes in the educational milieu of the students in mid-training.

Good nutrition is important in achieving oral and general health and dietary advice is a key component of primary prevention. Dental practitioners, therefore, must be knowledgeable in advocating healthy eating and drinking habits. It is important for dental students to recognise the role of nutrition through the curriculum[19,20] and to be able to counsel patients on the contribution of diet to their oral health. Students' behaviour and knowledge towards their own nutrition were observed in the present study through a sample seven-day diet diary. Most students were of healthy weight, based on a BMI range of 19.0-24.9kg/m^2; 22 students were underweight (BMI <19.0 kg/m^2), and three were overweight (BMI 25.0-29.9 kg/m^2).[21] Analysis of diaries indicated most students (98%) fulfilled or exceeded the RDI for the meat/fish/eggs/poultry food group,[9] but the RDIs for the other food groups were met by ≤34% of students. The low fruit and vegetable intake in particular reflects the average Australian diet today – the 2007-2008 National Health Survey of the Australian Bureau of Statistics reported that 96.5% of those surveyed in Victoria consumed fruits and vegetables inadequately and only 6.2% Australians aged 15 years and above met the RDI for fruit and vegetable consumption.[22] Students' dietary patterns are influenced by multiple factors, for example, high stress levels may affect appetite and food choices adversely, and hamper the ability to prepare a balanced, nutrient-dense meal.[23,24] Similarly low intakes for fruit, vegetables and dairy products have been reported for first year college students at a Canadian university and attributed in part to living away from home for the first time.[25] Since many students in the present study consumed their main meals in local food outlets near the Dental School, it is possible that food choices were influenced by similar familial and social factors.

Comparison of diet diary entries with their questionnaire responses confirmed their snacking behaviours for approximately half the students, and for chocolate consumption (68% agreement), but not for gum chewing (17%). Of note, snack choices differed considerably between responses to the oral health behaviour question (name of last snack) and diary entries. While questionnaire responses showed a dominance of sweets and chocolates (32%), followed by savouries, chips, and crackers (21%), the diaries showed a more favourable snack pattern occurred when a 7-day sample was examined, when fruit, vegetables, nuts and juices (38%) dominated as snack items. Frequent snacking is a common behaviour, possibly related to lifestyle and stress, and has been noted by others concerning food intake of university students.[25]

Sports drink consumption decreased considerably in 2011. Sports drinks were relatively popular in 1997 due to contemporaneous marketing and social factors. Since then, the decline in consumption in 2011 may reflect increased awareness of dental erosion,[26,27] which was an emphasis in recent oral health promotions of the Australian Dental Association. The proportions of students reporting sport drink consumption mid-training and in final years were similar (18%).[5] Gum-chewing also declined in 2011; the popularity of gum-chewing in 1997 may have reflected a current trial in the Dental School testing the efficacy of a gum containing casein phosphopeptide-amorphous calcium phosphate on caries prevention and remineralisation.[28]

Tobacco smoking is detrimental to oral health and general health.[29,30] Although the prevalence of smoking has decreased in recent years in Australia, 20.1% of 18-24 yr olds surveyed nationally in 2007-2008 were current smokers.[22,30] The smoking rate of dental students is one of the lowest in comparison with other health care professionals.[31] Despite known detrimental health effects of tobacco through dental school teaching and public awareness campaigns, a few dental students mid-training in both 1997 and 2011 reported previous smoking (11%) and current

smoking (3%), and also disagreed or strongly disagreed with Statement 8 that 'I consider smoking could have an effect on my teeth or gums'. This determination may reflect greater autonomy and independent decision-making concerning self-care amongst students in their 3rd and 4th years of training which correspond with reaching twenty-one years of age – generally regarded socially as beginning of adulthood. In comparison, the previous study of final year students in 2001-2009 found 5% smoked currently.[5] Ongoing smoking cessation programs continue to be necessary in dental school curricula.

Conclusion

This cross-sectional study of self-reported oral health behaviours and attitudes of dental students mid-training in 2011 and compared with same-year students in 1997, found that favourable oral health behaviour was evident at both time periods, with significant improvements in some habits in 2011. Favourable changes over time included increased flossing and flossing frequency, greater recognition of oral health as a reflection of general health, and of the importance of regular dental attendance. Smoking patterns remained unchanged with 3% of students continuing to smoke, indicating a need for continued health promotion among dental students concerning smoking cessation. High snacking frequency and low intakes in several food groups (fruit and vegetables, breads and cereals, milk and cheese, fluids) by students in 2011 suggest a need for reinforcement of the value of healthy dietary habits with a wide variety of foods, not only for students' own well-being but also to help fulfill their professional role in advocating a healthy balanced diet closely related to oral health.

Acknowledgements

All participating 3rd and 4th year dental students in 1997 and 2011 are thanked sincerely for their contribution. The support of Colgate Oral Care Australia for the provision of oral health care kits for participating students in 1997 is acknowledged with gratitude. Ms Alice Whang was supported by an award from the Australian Dental Research Foundation in 2011-2012 for this study.

References

1. Petersen PE. World Health Organization global policy for improvement of oral health – World Health Assembly 2007. Int Dent J 2008:58:115-121.
2. Löe H. Oral hygiene in the prevention of caries and periodontal disease. Inter Dent J 2000: 50: 129–139.
3. Johnson NW. The role of the dental team in tobacco cessation. Eur J Dent Educ 2004:8 Suppl 4:18-24.
4. Watt RG, Marinho VC. Does oral health promotion improve oral hygiene and gingival health? Periodontology 2000 .2005: 37: 35–47.
5. Messer LB, Calache H. Oral health attitudes and behaviours of final-year dental students. Eur J Dent Educ 2012;16:144-155.
6. Perneger TV. What's wrong with Bonferroni adjustments. Br Med J 1998:316:1236-1238.
7. Taste. Available at: www.taste.com.au. Last accessed October 2, 2012.
8. Recipes.com. Available at: www.recipe.com Last accessed October 10, 2012.
9. Dietary Guidelines for Australians. National Health and Medical Research Council, Australian Department of Health and Ageing, 2005. Available at: http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n31.pdf?q=publications/synopses/_files/n31.pdf. Last accessed October 2, 2012.
10. Twetman S, Axelsson S, Dahlgren H, Holm AK, Kallestal C, Lagerlof F, Lingstrom P, Mejare I, Nordenram G, Norlund A. Caries-preventive effect of fluoride toothpaste: a systematic review. Acta Odont Scand 2003: 61: 347-355.
11. Wong MC, Clarkson J, Glenny AM, Lo EC, Marinho VC, Tsang BW, Walsh T, Worthington HV. Cochrane reviews on the benefits/risks of fluoride toothpastes. J Dent Res 2011: 90: 573-579.
12. Sambunjak D, Nickerson JW, Poklepovic T, Johnson TM, Imai P, Tugwell P, Worthington HV. Flossing for the management of periodontal diseases and dental caries in adults (Review). Cochrane Library 2007. Available at: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008829.pub2/pdf. Last accessed October 2, 2012.
13. McCullough M, Farah C. The role of alcohol in oral carcinogenesis with particular reference to alcohol-containing mouthwashes. Aust Dent J 2008: 53: 302–305.
14. The Australian. Mouthwash multiplies risk of cancer up to nine times.Published 2/12/2009. Available at: http://www.theaustralian.com.au/news/nation/mouthwash-multiplies-risk-of-cancer-up-to-nine-times/story-e6frg6nf-1225805928465. Last accessed October 2, 2012.
15. Newman MG, Takei HH, Carranza FA. Carranza's Clinical Periodontology, 9th edn, Philadelphia, PA: WB Saunders, 2002:194.
16. Teusner DN, Christopoulos S, Spencer AJ. Projected demand and supply for dental visits in Australia: Analysis of the impact of changes in key inputs. Dental Statistics and Research Series. Australian Institute of Health and Welfare 2008: 26-28.
17. Cullinan MP, Ford PJ, Seymour GJ. Periodontal disease and systemic health: current status. Aust Dent J 2009: 54: S62–S69.
18. Dental Health Services Victoria. Annual Report, 2011. Available at: www.dhsv.org.au/download/cabd7672/annual-report-2011.pdf. Last accessed 3 October 2012.
19. Julien M. Nutrition: its role in dental training and practice. J Canad Dent Assoc 2000: 66: 97-99.
20. McHarg J, Kay EJ. Designing a dental curriculum for the twenty-first century. Br Dent J 2009: 207: 493-497.
21. Garrow J, Webster J. Quetelet's index (W/H2) as a measure of fatness. Int J Obes 1985:9:147-153.
22. National Health Survey: Summary of Results; Victoria, 2007-2008 (Re-Issue). 2011. Australian Bureau of Statistics. Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4362.02007-2008%20(Reissue)?OpenDocument. Last accessed October 2, 2012.
23. Humphris G, Blinkhorn A, Freeman R. Psychological stress in undergraduate dental students: baseline results from seven European dental schools. Eur J Dent Educ 2002: 6: 22-29.
24. Sanders AE, Lushington K. Sources of stress for Australian dental students. J Dent Educ 1999: 63: 688-697.
25. Brunt A, Rhee Y, Zhong L. Differences in dietary patterns among college students according to body mass index. J Amer Coll Health 2008: 56: 629-634.
26. Sirimaharaj V, Brearley Messer L, Morgan MV. Acidic diet and dental erosion among athletes. Aust Dent J 2002: 47: 228-236.
27. Cochrane NJ, Cai F, Yuan Y, Reynolds EC. Erosive potential of beverages sold in Australian schools. Aust Dent J 2009: 54: 238–244.
28. Reynolds EC. Calcium phosphate-based remineralization systems: scientific evidence? Aust Dent J 2008: 53: 268–273.
29. Newman MG, Takei HH, Carranza FA. Carranza's Clinical Periodontology, 9th edn, Philadelphia, PA: WB Saunders, 2002:245-250.
30. Rahman A, Harding A. Social and health costs of tobacco smoking in Australia:Level, Trend and Determinants. Int J Stat Syst 2011: 6: 477-489.
31. Smith DR, Leggat PA. An international review of tobacco smoking among dental students in 19 countries. Int Dent J 2007: 57: 452-458.

CONTINUED ON PAGE 17...

Survival Of Glass-Ionomer Cement Restorations Placed In School Children In Rural Vietnam

Mimi Huynh BDSc, Louise B. Messer AM, MDSc, PhD, FRACDS, FICD and James A. Robertson AM, BDS, BA, MA, MPH, FRACDS, FICD, FADI
Melbourne Dental School, The University of Melbourne, Victoria, Australia
Corresponding Author:
Emeritus Professor Louise Brearley Messer AM,
Paediatric Dentistry, Melbourne Dental School, The University of Melbourne,
720 Swanston Street, Carlton 3010, Victoria, Australia
Email: ljbm@unimelb.edu.au

Abbreviations:

RAVDH = Rotary Australia-Vietnam Dental Health
GIC = Glass-Ionomer Cement
USPHS = United States Public Health System

Abstract

Background: The Rotary Australia-Vietnam Dental Health (RAVDH) Project is a humanitarian program that endeavors to provide much-needed dental services and oral health promotion in rural Vietnam. The survival (retention, caries and quality) of glass-ionomer cement (GIC) restorations placed by previous RAVDH Project teams in 12 year-old school children using minimal intervention cavity preparations under fieldwork conditions in the village of Phu Giao (Binh Duong Province) Vietnam, was studied in 2013. Previous studies have found these children to be at high caries risk. ***Methods:*** A total of 169 school children treated in 2010-2012 by RAVDH Project teams were recalled and examined under fieldwork conditions. Survival of 447 GIC (Fuji IX™) restorations in permanent posterior teeth was assessed using United States Public Health System criteria. ***Results:*** The sample contained 89 females (53%) and 80 males (47%); the mean age at examination was 13.8 years. A total of 364 restorations were verifiable as present clinically and 3 were missing; the status of 80 restorations was unverifiable due to extensive calculus and/or plaque overlying the teeth. Most restorations were placed on first permanent molars (69%) or second permanent molars (19%). Retention rates for verifiable restorations in place after 1, 2 and 3 years were 98%, 100% and 100% respectively. Of these, 308 restorations (85%) were caries-free; 56 (15%) were associated with caries. On collapsing ratings (Alpha, Bravo, Charlie) for three criteria (marginal discoloration, anatomical form, marginal adaptation) as an overall quality rating for caries-free restorations, 212 (69%) restorations scored Alpha for all three criteria, and 62 (20%) scored Alpha for two criteria plus Bravo for one criterion. ***Conclusions:*** This cross-sectional study of GIC restorations placed under fieldwork conditions in minimal intervention cavity preparations showed verifiable restorations were well retained up to three years, but were associated with high caries experience. Extensive calculus and/or plaque accumulation precluding assessment of many restorations demonstrated the urgent need for oral hygiene promotion for school children living in rural Vietnam.

Introduction

Previous studies on the survival of glass-ionomer cement (GIC) restorations placed in children under fieldwork conditions appear to be limited to the application of the Atraumatic Restorative Technique (ART).[1-4] This technique involves removal of soft, demineralised dentine only, from accessible lesions using hand instruments and without local anaesthesia, followed by restoring the cavity and sealing associated pits and fissures with an adhesive material such as GIC.[5] In contrast, the minimal intervention technique (MIT) conducted in fieldwork settings includes the use of local anaesthesia and rotary instrumentation to achieve minimal cavity preparation prior to placement of GIC.[6]

Four studies of GIC (Fuji IX™, GC Asia Dental Pte Ltd, Singapore) restorations placed under fieldwork conditions in children in Zimbabwe, Tanzania, China and Tunisia, using the ART approach, are summarized in ***Table 1 (next page)***.[1-4] Retention rates after 1-2 years for three of the studies ranged from 88.3% to 96.3%.[1-3] Clinician experience was noted as a factor in the study from Zimbabwe, where experienced clinicians placed better ART restorations than inexperienced clinicians.[1] The low retention rate for restorations placed in permanent molars in the study conducted in Tunisia was attributed to low participation at the recall examination.[4]

The Rotary Australia-Vietnam Dental Health Project (RAVDHP)

The Rotary Australia-Vietnam Dental Health (RAVDH) Project was established in 1991 with the intention of providing much-needed dental services and encouraging oral health in rural Vietnam. Since then, the humanitarian aid project has donated dental equipment and materials to local hospitals, implemented the provision of basic dental treatment, and encouraged tooth brushing programs in local schools. In addition, the RAVDH Project has established relationships with local staff at the National Hospital of Odontostomatology, Ho Chi Minh City, in order to exchange knowledge and provide continued professional development. Basic dental treatment is provided annually by groups of dentists, dental auxiliaries and dental assistants participating in the RAVDH Project. Teams have travelled annually to rural villages in Vietnam to deliver oral health promotion and restorative treatment to local school children, principally GIC restorations, placed using minimal cavity preparations. The restorative treatment aimed to improve the quality of life of the school children by maintaining teeth for function and esthetics.

In 2009, the survival of GIC (Fuji IX™) restorations placed previously by clinicians of the RAVDH Project in 2008 was assessed.[7] A total of 114 GIC restorations in 33 school children living in the village of Ben Cau (Tay Ninh Province), were examined ***(Table 1)***. The restorations had

Table 1: Summary of studies conducted under fieldwork conditions of glass-ionomer cement restorations placed in children using atraumatic restorative (ART) or minimal intervention techniques (MIT).

Publication	Children and fieldwork location	Clinician/s and conditions	Study type and sample	Restoration survival
Frencken et al., 1998[1]	42, 14 yr-olds, Zimbabwe	Dentists, dental therapists, no assistants, treated in classroom	297 ART one-surface Fuji IX rest'ns placed, 206 assessed	88.3% (3 yr)
Kikwilu et al., 2001[2]	161, 8-15 yr-olds, Morogo municipality, Tanzania	Not reported	296 ART Fuji IX rest'ns placed, 238 assessed, 92% on perm't molar occl surfaces	96.1% (1 yr)
Lo et al., 2001[3]	82, 6-14 yr-olds, Wuhan, Hubei Province, China	Dentist, trained assistant, treated on table, portable clinical light	92 ART Fuji IX occl rest'ns placed, primary and perm't molars	Prim molars: 90.2% (2 yr) Perm't molars: 96.3% (2 yr)
Abid et al., 2002[4]	242, 3-15 yr-olds, Monastir, Tunisia	Dentists	223 ART one-surface Fuji IX rest'ns placed	Prim molars: 45.7% (3 yr) Perm't molars: 27.8% (3 yr)
Van et al., 2010[7]	33, 12 yr-olds, Ben Cau, Vietnam	Dentists, dental therapists, trained assistants, treated in dental clinic	114 MIT one-surface Fuji IX rest'ns placed	87.0% (1 yr)

been placed under fieldwork conditions using the MIT approach. Survival was assessed in terms of retention and quality, using the United States Public Health System (USPHS) clinical criteria.[8] At the 12-month recall, 99 (87%) of restorations were present, 6 (5%) were partially missing and 9 (8%) were completely missing.[7] Of the 114 restorations, 95 (83%) were free of marginal discoloration, 85 (75%) were scored Alpha for anatomic form and 79 (69%) of restorations were scored Alpha for marginal adaptation. This appears to be the only report in the literature assessing the survival of GIC restorations placed under fieldwork conditions using minimal intervention cavity preparations.

Glass-Ionomer Cement

Glass-ionomer cement (GIC) is a restorative material commonly used in both conventional cavity preparations and minimal intervention cavity preparations.[9] The material is particularly attractive for use in the latter, due to its ability to adhere to enamel and dentine, to release and take up fluoride, and to its chemical setting reaction.[9] The enhanced mechanical properties and relatively slow setting time of high viscosity GIC make it particularly useful in fieldwork settings. The GIC used in restorations assessed in the present study was Fuji IX™ Glass-Ionomer Cement (GC Asia Dental Pte Ltd, Singapore).

Study aim

This study was undertaken in conjunction with the RAVDH Project 2013 with the aim of expanding observations reported previously in 2009 on the survival rates of GIC (Fuji IX™) restorations,[7] with a larger sample of children and teeth. The GIC restorations were examined up to 3 years after placement in minimal intervention cavity preparations under fieldwork conditions in school children in the village of Phu Giao (Binh Duong Province) Vietnam, by RAVDH Project teams in 2010-2012.

Materials and methods

The Rotary Australia-Vietnam Dental Health (RAVDH) Project 2013

As part of the RAVDH Project 2013, one of two field teams consisting of two dentists, three dental nurses and two final year dental students were assigned to the rural village of Phu Giao (Binh Duong Province), to deliver restorative care and oral health promotion in the first week of placement. Accompanying the team were a local Vietnamese interpreter and two local staff members of the National Hospital of Odontostomatology, Ho Chi Minh City. The team spent five days in Phu Giao and in the second week of placement alternated with the second field team in providing similar services in the rural village of Ca Mau (Ca Mau Province), Vietnam.

Dental equipment, materials and oral hygiene cleaning aids (toothbrushes, toothpastes) were brought from Australia to the local community dental clinic in Phu Giao. Two rooms were equipped for providing restorative care at the clinic: one room had a dental chair, functional dental unit and overhead light; the second room had a stretcher bed and a portable dental unit. Neither room had high speed or slow speed suction; portable head torches were used as required. Children were triaged in a third room by field team dentists from the Project. Oral health education was given outside the clinic, using interactive learning activities and demonstrations. Children requiring treatment received restorations or fissure sealants or both using GIC; some anterior teeth were restored with resin composite to improve aesthetics.

Study Sample

This study was conducted with ethics approval from the Human Ethics Committee, University of Melbourne, and followed the National Health and Medical Research Council Guidelines. School children treated by the RAVDH Project in Phu Giao in the last three years (2010-2012) were recalled to participate in this study. Only children who had attended on the first day of the team's visit to Phu Giao of each year were recalled as it was not possible to recall and examine all patients due to time constraints. A total of 216 school children were invited to participate in the study. Of these, 169 (78%) children attended and a total of 447 GIC restorations placed in 2010, 2011 and 2012 were examined.

Plain language statements and informed consent forms were developed in English and Vietnamese by the authors then back-translated by a translator who was fluent in both languages. These forms were made available to parents for completion. Parental consent was assumed by the child's attendance at the appointed time and additional consent from the child was obtained at the time of examination. Participation in this study was completely voluntary and the decision to decline would not in any way affect future involvement with the RAVDH Project.

Placement of restorations by RAVDH Project teams in 2010-2012

The restorations were placed by multiple clinicians on RAVDH Project teams during visits in 2010-2012. After placement, these restorations were not followed up or repaired and the records did not identify the treating clinicians. All restorations were placed in the community dental clinic in

Table 2: Distribution of 169 children and 447 restorations placed over 1 to 3 years.

Distribution of children and restorations	Placement year (no. years of follow-up)			
	2010 (3 yrs) n (valid %)	2011 (2 yrs) n (valid %)	2012 (1 yr) n (valid %)	Total n (valid %)
Children:				
males	23 (55)	26 (45)	31 (45)	80 (47)
females	19 (45)	32 (55)	38 (55)	89 (53)
Total	42	58	69	169
Age at follow-up:				
range (yr/mo.)	14/3-16/1	13/3-16/10	12/3-15/1	12/3-16/10
mean (±SD) age (mo.)	176.8 (4.4)	170.3 (9.4)	155.5 (7.3)	165.9 (11.7)
Teeth restored:				
1st permanent molars	73 (69)	98 (73)	139 (67)	310 (69)
2nd permanent molars	16 (15)	31 (23)	40 (19)	87 (19)
bicuspids	17 (16)	6 (4)	27 (13)	50 (11)
Total	106	135	206	447
Surfaces restored:				
occlusal	91 (85)	98 (73)	187 (91)	376 (84)
two surfaces[a]	14 (13)	19 (14)	2 (1)	35 (8)
lingual	0	1 (1)	1 (0.05)	2 (0.04)
buccal	1 (1)	17 (13)	16 (8)	34 (8)
Total	106	135	206	447

[a] Occlusal plus lingual, buccal, mesial or distal surfaces.

Phu Giao where a dental chair, stretcher bed, rotary equipment, dental hand instruments, dental materials and artificial light source (either overhead light from dental chair or portable head torches) were available for use. Trained dental assistants from the RAVDH Project assisted clinicians. Minimal cavities were prepared with high speed and slow speed hand pieces with or without local anaesthesia as deemed necessary. Moisture control was obtained using cotton rolls and, if needed, the child was requested to expel excess saliva into a bucket as suction was unavailable. Dentinal caries and undermined enamel were removed and caries in close proximity to the pulp was left to arrest in order to avoid pulp exposure. Cavity preparations were then etched using dentine conditioner (Dentine Conditioner, GC Asia Dental Pte Ltd, Singapore) with 10% polyacrylic acid, washed and dried prior to placement of GIC (Fuji IX™) that was capsule-mixed following the manufacturer's instructions. A coating of Vaseline or cocoa butter was placed, occlusion was checked, and restorations were polished using Soflex discs or slow speed round burs as needed before returning the child to school under teacher supervision.

Dental examinations in 2013

In 2013, a total of 169 children were brought to the community dental clinic in Phu Giao (Binh Duong Province), in buses hired from the District Hospital. The survival (retention, caries and quality) of the GIC restorations placed in posterior permanent teeth (first and second permanent molars, premolars) was assessed using the USPHS clinical criteria.[8] One examiner (MH), who had not been involved in restoration placement, evaluated all restorations based on written descriptions of the criteria for assessment of marginal discoloration, anatomic form and marginal adaptation. The child lay on a stretcher bed for the examination. Time limitations precluded repeat examinations of a subset of children in order to calculate intra-examiner reliability.

The teeth were examined under artificial light or natural light (during recharging of the portable artificial torch), with the examiner standing in front of the child to examine mandibular teeth and behind the child's head to examine maxillary teeth. Direct and indirect vision was obtained using a mouth mirror. A periodontal probe (PerioWise, Premier Dental Products Co., PA, USA) was used to remove as much plaque as possible. Active dental caries was determined based on texture (soft to tip of periodontal probe) and presence of shadowing. A tooth surface was considered carious if there was an unmistakable cavitation, undermined enamel, or detectably softened cavity wall or floor.[10] Teeth were not cleaned, dried or radiographed due to lack of facilities. The examiner was aided by a local staff member from the National Hospital of Odontostomatology who hand-recorded assessments for each restoration as dictated by the examiner and also assisted in cold sterilization of instruments.

USPHS clinical criteria

The USPHS criteria[8] for evaluation of dental restorative materials in situ were used as follows:

Marginal Discoloration: Alpha: no discoloration anywhere along the margin between the restoration and the tooth structure; Bravo: discoloration along the margin between the restoration and tooth structure, but the discoloration has not penetrated along the margin in a pulpal direction; Charlie: discoloration along the margin between the restoration and the tooth structure, and the discoloration has penetrated along the margin in a pulpal direction.

Anatomic Form: Alpha: restoration is continuous with existing anatomic form; Bravo: restoration is under-contoured, i.e., there is material missing, but there is no exposed dentine; Charlie: restoration is under-contoured, i.e., material is missing and there is exposed dentine.

Marginal Adaptation: Alpha: No visible evidence of a crevice along the margin; Bravo: visible evidence of a crevice along the margin but there is no exposed dentine; Charlie: visible evidence of a crevice along the margin and there is exposed dentine, but the restoration is not mobile, fractured or missing (in part or completely); Delta: visible evidence of a crevice along the margin, there is exposed dentine, and the restoration is mobile, fractured or missing (in part or completely).

Statistical analysis

The hand-recorded assessments were entered into Excel spreadsheets (Microsoft Corp., Seattle, Washington, USA) and distributions were studied using descriptive statistics.

Results

Distribution of children and teeth restored

The distribution of the 169 children by gender and age at recall is shown ***(Table 2)***. More females than males were examined (53% vs 47%). The mean age at follow-up was 165.9 months (13.8 years). Of 447 restorations placed, most were on first permanent molars (n = 310, 69%) and second permanent molars (n = 87, 19%), and typically on occlusal surfaces (n = 376, 84%).

Status of restorations at recall examination

At examination, 364 restorations were verifiable clinically as present, 3 were missing and the status of 80 restorations was unverifiable due to large

Table 3: Status at recall of 447 restorations placed over 1 to 3 years.

Distribution of children and restorations	Placement year (no. years of follow-up)			
	2010 (3 yrs) n (valid %)	2011 (2 yrs) n (valid %)	2012 (1 yr) n (valid %)	Total n (valid %)
Restoration status:				
Verifiable	91 (86)	104 (77)	172 (82)	367 (82)
present	91 (100)	104 (100) [a]	169 (98)[a]	364 (99)
missing	0	0	3 (2)	3 (1)
Unverifiable [b]	15 (14)	31 (23)	34 (17)	80 (18)
Total	106	135	206	447
Marginal discoloration: [c]				
Alpha	68 (75)	55 (53)	145 (86)	268 (74)
Bravo	19 (21)	44 (42)	18 (11)	81 (22)
Charlie	4 (4)	5 (5)	6 (4)	15 (4)
Anatomical form: [d]				
Alpha	72 (79)	75 (72)	148 (88)	295 (81)
Bravo	18 (20)	29 (28)	20 (12)	67 (18)
Charlie	1 (1)	0	1 (1)	2 (0.5)
Marginal adaptation: [e]				
Alpha	53 (58)	75 (82)	150 (89)	278 (76)
Bravo	34 (37)	24 (23)	18 (11)	76 (21)
Charlie	3 (3)	5 (5)	1 (1)	9 (2)
Delta	1 (1)	0	0	1 (0.03)
Caries:				
not present	68 (75)	83 (80)	157 (93)	308 (85)
present	23 (25)	21 (20)	12 (7)	56 (15)
Overall status of restorations:				
3 Alphas, no caries	41 (45)	45 (54)	126 (80)	212 (69)
2 Alphas, 1 Bravo, no caries	18 (20)	23 (28)	21 (13)	62 (20)
1 Alpha, 2 Bravos, no caries	6 (7)	3 (4)	8 (5)	17 (6)
3 Bravos, no caries	2 (2)	10 (12)	1 (1)	13 (4)
1 Charlie or Delta, no caries	1 (1)	2 (2)	1 (1)	4 (1)

a Includes 1 partially missing restoration.

b Status of restoration unverifiable due to plaque and/or calculus accumulation partially or fully covering crown of tooth.

c Marginal Discoloration: Alpha: No discoloration anywhere along the margin between the restoration and the tooth structure. Bravo: Discoloration along the margin between the restoration and tooth structure, but the discoloration has not penetrated along the margin in a pulpal direction. Charlie: Discoloration along the margin between the restoration and the tooth structure, and the discoloration has penetrated along the margin in a pulpal direction.

d Anatomic Form: Alpha: Restoration is continuous with existing anatomic form. Bravo: Restoration is under-contoured, i.e., there is material missing, but there is no exposed dentine. Charlie: Restoration is under-contoured, i.e., there is material missing and there is exposed dentine.

e Marginal Adaptation: Alpha: No visible evidence of a crevice along the margin. Bravo: Visible evidence of a crevice along the margin but there is no exposed dentine. Charlie: Visible evidence of a crevice along the margin and there is exposed dentine, but the restoration is not mobile, fractured or missing (in part or completely). Delta: Visible evidence of a crevice along the margin, there is exposed dentine, and the restoration is mobile, fractured or missing (in part or completely).[8]

accumulations of calculus and/or plaque over the crown surface that could not be removed adequately with the available equipment ***(Table 3)***. Two restorations were partially lost (2011:1; 2012:1). No clinical assessments could be made on the unverifiable restorations.

Restoration quality was assessed for marginal discoloration, anatomical form and marginal adaptation ***(Table 3)***. The frequencies of Alpha ratings decreased with time since placement for all three criteria. Of 364 restorations, 268 (74%) were rated as Alpha for marginal discoloration; most of these had been in place 1 year (145 restorations). Anatomical form scored higher than marginal discoloration for restorations in place 1 year, 2 years or 3 years, with 88%, 72% and 79% respectively rated as Alpha. The frequencies of Alpha ratings for marginal adaptation showed the greatest decrease, declining from 89% (1 year), to 82% (2 years) and 58% (3 years).

Of 364 restorations, 308 (85%) were judged free of associated caries and 56 (15%) were associated with caries ***(Table 3)***. The prevalence of caries associated with restorations increased with time since placement, affecting 7% of those in place 1 year, 20% in place 2 years, and 25% in place 3 years. The ratings (Alpha, Bravo, Charlie) for the three criteria (marginal discoloration, anatomical form, marginal adaptation) were collapsed to form an overall quality rating for the caries-free restorations. Of 308 such restorations, 212 (69%) were judged as Alpha for all three criteria, and a further 62 restorations (20%) were judged as Alpha for two criteria plus Bravo for the third criterion. The distribution of restorations with three Alphas decreased with increasing time since placement: of those in place 1 year (2012: 80% with three Alphas), in place 2 years (2011: 54%), and in place 3 years (2010: 45%).

Distribution of treated dentitions and survival of restorations at recall

A total of 169 dentitions were examined ***(Table 4)***. Most dentitions (55%) had received 1-2 restorations and a further 34% received 3-4 restorations; 18 dentitions had received 5 or more restorations. Complete survival of all restorations (i.e., all scoring Alpha for all three criteria) was seen for 39% of dentitions after 1 year and declined thereafter. For 55 dentitions (32%) where one or more restorations had been placed, the presence of calculus and/or plaque covering tooth crowns prevented assessment of these restorations. Only 82 of 169 dentitions (48%) were judged free of caries associated with the restorations, including 44 dentitions (26%) where all restorations showed complete survival and 38 dentitions (22%) with incomplete survival of restorations. Caries was associated with one or more restorations in 43 dentitions (26%), including 30 dentitions (18%) where no restorations were missing and 13 dentitions (8%) where one or more restorations were unverifiable.

Discussion

This cross-sectional study of 447 GIC (Fuji IX™) restorations placed using the MIT approach under fieldwork conditions in 169, 12 year-old school children in rural Vietnam (village of Phu Giao) was an extension of the preliminary study conducted in the village of Ben Cau in 2009 in association with a RAVDH Project team visit.[7] Dental clinical facilities, local anaesthesia and rotary instrumentation, were available and used as necessary during the restorative procedures, but principles of minimal intervention[11] were used during cavity preparation. The MIT approach has been used consistently by RAVDH Project teams in all years studied in both the preliminary and the present studies. The sample of children and

Table 4: Distribution of treated dentitions and survival of restorations at recall at 1 to 3 years.

Distribution of dentitions	Placement year (no. years of follow-up)			
	2010 (3 yrs) n (valid %)	2011 (2 yrs) n (valid %)	2012 (1 yr) n (valid %)	Total n (%)
No. dentitions	42	58	69	169
No. restorations placed in permanent teeth per dentition: 1-2 3-4 5-6 7-8	 22 (52) 15 (36) 5 (12) 0	 40 (69) 14 (24) 3 (5) 1 (2)	 31 (45) 29 (42) 6 (9) 3 (4)	 93 (55) 58 (34) 14 (8) 4 (2)
Complete survival[a] of all restorations placed and no caries in restored teeth	9 (21)	8 (14)	27 (39)	44 (26)
Incomplete survival[b] of ≥ 1 restoration/s and no caries in restored teeth	9 (21)	18 (31)	11 (16)	38 (22)
≥ 1 restoration/s missing and no caries in restored teeth	0	0	2 (3)	2 (1)
≥ 1 restoration/s unverifiable[c] and no caries in restored teeth	7 (17)	14 (24)	21 (30)	42 (25)
Caries present in ≥ 1 restored teeth and no missing restorations	12 (29)	12 (21)	6 (9)	30 (18)
Caries present in ≥ 1 restored teeth and ≥ 1 restoration/s unverifiable	5 (12)	6 (10)	2 (3)	13 (8)

a Complete survival of all restorations placed in the dentition, i.e., all restorations rated as three Alphas for marginal discoloration, anatomical form and marginal adaptation.

b Incomplete survival of all restorations placed in the dentition, i.e., one or more restorations not rated as three Alphas for marginal discoloration, anatomical form and marginal adaptation.

c Status of restoration unverifiable due to heavy plaque and/or calculus partially or fully covering crown of tooth.

restorations in the present study was larger than in the preliminary study where 33 children were treated by Project clinicians and 114 restorations were assessed after 1 year.[7] Similar to other reports of studies conducted under fieldwork conditions,[1-4] most restorations placed in school children were on first permanent molars (69%) followed by second permanent molars (19%). The recall examinations in the present study were hampered clinically by the unavailability of instruments for removing plaque and calculus from restored teeth, resulting in the status of 80 of 447 (18%) restorations being unverifiable and therefore excluded from assessment for retention, caries and quality.

The retention rates of verifiable restorations in the present study at 1 year, 2 years and 3 years (98-100%) were higher than observed in the four ART studies of children conducted under fieldwork conditions and utilizing the same GIC material, Fuji IX™.[1-4] The present retention rates also exceeded the 87.0% retention reported from the preliminary RAVDH Project study in 2009.[7] However, a number of retained restorations were associated with caries, which increased from affecting 7% of restorations in place for 1 year to 20% (2 years) and 25% (3 years). Previous studies by the present authors have shown that children in rural villages in Vietnam visited by RAVDH Project teams are at high caries risk from a highly cariogenic diets, with frequent between-meal snacking and poor oral hygiene.[12-14] Although the placement of GIC restorations can improve the function, form and aesthetics of a child's dentition, restorations do not ensure the tooth surfaces will remain caries-free. If caries-risk factors outweigh protective factors, the balance between remineralisation and demineralisation is tipped towards pathology; caries and restorative failure can result. This is particularly true as the treated children were deemed to be of high caries risk.

Use of minimal intervention cavity preparations in such dentitions may lead to inadequate caries removal and involve placing GIC into deep cavities poorly accessed through small openings. Lack of intra-oral suction and appropriate artificial lighting of correct intensity may also limit lesion visibility for sound judgment concerning adequate caries removal for clinicians during cavity preparation. The restricted lighting and the lack of suction, triplex syringe and instruments to remove calculus and plaque, were also constraints that limited the examiner in assessing restorations at recall in the present study.

The frequencies of Alpha ratings for the quality of marginal discoloration, anatomical form and marginal adaptation of restorations all decreased with time since placement. Anatomical form was least affected, but marginal adaptation decreased from 89% (1 year) to 82% (2 years) and 58% (3 years). Since the restorations were placed under fieldwork conditions, a number of factors may have contributed to loss of restoration quality.[1,2,4] These include: salivary contamination during GIC insertion into the cavity due to lack of intra-oral suction; improper mixing of the GIC resulting in material crumbling and eventual loss;[1] difficulty inserting the material through small openings and deep cavities resulting in voids beneath the surface which later fractures under occlusal pressure;[4] hot and humid weather conditions lengthening the material's working time, and GIC insufficiently set before occlusal forces were applied resulting in loss of marginal contours and adaptation. Despite its many advantages, GIC is unsuitable for stress-bearing areas due to low fracture toughness and crack propagation under stress, leading to clinical wear, loss of anatomical form and loss of marginal adaptation.[11]

The heavy load of calculus and/or plaque obscuring the crowns of 18% of restored teeth and precluding restoration assessment was an unexpected finding in the present study. Suitable instruments for scaling and prophylaxis of teeth, and equipment for instrument sterilization, were not available for the examiner to address the accumulations. Further, time constraints for conducting the study within the brief time available to the RAVDH Project team in the village also precluded thorough cleaning of dentitions prior to assessing restorations.

Despite unexpectedly low survival rates of some restorations noted in this study, school children still benefitted considerably from receiving treatment provided by the RAVDH Project. Financial constraints and lack of access to professional dental care would otherwise have prevented them from receiving any restorative treatment and they would have continued to suffer from caries and its sequelae of pain, sensitivity, infection, pulpal necrosis and loss of aesthetics. Also, children were exposed to oral health interactive learning

and received basic oral hygiene materials (toothbrushes, toothpastes) and instructions for maintenance of oral hygiene at home.

Further studies on the survival rates of high viscosity GIC restorations placed using rotary instruments under fieldwork conditions are needed. Such studies could help identify the preferred technique (e.g., MIT or ART) enabling best restoration survival, contribute to dental health policy-making and implementation in rural developing communities, and aid clinicians in making evidence-based decisions on treatment planning, choice of materials, procedures and appropriate recalls for such restorations. This would improve dental care at both the individual and community levels, reducing the burden of caries and its associated pain and discomfort.

Recommendations

To improve clinical outcomes of GIC (Fuji IX™) restorations placed under fieldwork conditions in association with future RAVDH Project team visits to rural communities, the following recommendations are made. Wherever possible, clinicians should be provided with artificial light of appropriate intensity to improve working vision, suction to aid moisture control, and access to a triplex syringe during restorative procedures. Dental materials should be stored in a cool area according to the manufacturer's instructions in order to maintain their optimal properties. The application of a low viscosity nano-filled resin coating (G-Coat Plus, GC Co., Tokyo, Japan) to the surfaces of GIC (Fuji IX™) restorations may reduce the wear of occlusal restorations.[11] Since a high calculus and/or plaque load was noted in some children that precluded assessment of restorations, teams conducting recall visits should consider including scalers in the instrumentation kits and advise children to brush their teeth thoroughly before assessment. Appropriate sterilizing equipment and time allocation would then need to be addressed.

The RAVDH Project teams currently provide dental treatment and oral health education to 12 year-old school children in rural villages. By this age in such a high caries-risk group, carious lesions typically have progressed to the extent that restorations are necessary to restore function, form and esthetics. The location, low socioeconomic status, lack of oral hygiene and Westernisation of local diets with increasing refined sugar content, all serve to increase caries-susceptibility and maintain children at high caries risk. Recognising that prevention is better than cure, and that preventive approaches are readily available, it is paramount under these circumstances to reduce the burden of disease at the individual, community, and national levels. Introducing the use of fissure sealants, topical fluoride therapy, oral hygiene instructions and diet counseling programs would be very beneficial preventive measures during key stages, e.g., at completion of eruption of the primary dentition (2-3 years), of first permanent molars (5-7 years old) and second permanent molars (11-14 years old).[15] Liaising with the National Hospital of Odontostomatology for such preventive programs to be implemented in these age groups could help reduce caries experience as well as the need for restorative treatment. Dental services and projects delivering humanitarian aid should constantly monitor and evaluate their procedures in order to strive for higher standards and work modifications.

Conclusions

This cross-sectional study of GIC (Fuji IX™) restorations placed in minimal intervention cavity preparations in school children in rural Vietnam under fieldwork conditions, showed verifiable restorations were well retained up to three years, but were associated with high caries experience. Calculus and/or plaque accumulation precluding assessment of many restorations demonstrated the urgent need for oral hygiene promotion for these school children. Preventive measures and restorative care continue to be urgently needed in school children living in rural Vietnam.

Acknowledgements

The authors acknowledge with gratitude the financial support of GC Corporation; the Rotary Vietnam Dental Health Project 2013 team for providing the opportunity for this study and for funding the transportation for the school children in Phu Giao; colleagues in Melbourne, Australia for their kind assistance with the back-translations from Vietnamese to English; local dental staff of the Phu Giao District Health Centre for their assistance and hospitality; and the staff of the National Hospital of Odontostomatology, Ho Chi Minh City for their support. Mimi Huynh in particular would like to personally thank co-authors Louise Brearley Messer and Jamie Robertson for their ongoing mentorship, guidance and encouragement throughout this study.

For further information on the Rotary Australia-Vietnam Dental Health Project, readers are encouraged to contact Dr. Jamie Robertson, on: jro24161@bigpond.net.au

Bibliography

1. Frencken JE, Makoni F, Sithole WD. ART restorations and glass ionomer sealants in Zimbabwe: survival after 3 years. Community Dent Oral Epidemiol. 1998;26:372-81.
2. Kikwilu EN, Mandari GJ, Honkala E. Survival of Fuji IX ART fillings in permanent teeth of primary school children in Tanzania. East Afr Med J. 2001;78:411-3.
3. Lo ECM, Luo Y, Fan MW, Wei SHY. Clinical investigation of two glass-ionomer restoratives used with the atraumatic treatment approach in China: two-year results. Caries Res. 2001;35:458-63.
4. Abid A, Chkir F, Ben Salem K, Argoubi K, Sfar-Gandoura M. Atraumatic restorative treatment and glass ionomer sealants in Tunisian children: survival after three years. East Mediterr Health J. 2002;8:315-23
5. Tyas MJ, Anusavice KJ, Frencken JE, Mount GJ. Minimal intervention dentistry – a review. FDI Commission Project 1-97. Int Dent J. 2000;50:1-12.
6. Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, Eden E. Minimal intervention dentistry for managing dental caries – a review: Report of FDI Task Group. Int Dent J. 2012;62:223-43.
7. Van TTT, Messer LB, Robertson JA. Oral health of school children in rural Vietnam. Part III. High intake of dietary sugars and high caries experience. Synopses 2010;44:8-16.
8. Cvar JF, Ryge G. Reprint of criteria for the clinical evaluation of dental restorative materials. Clin Oral Invest. 2005;9:215-232.
9. Bonifácio CC, Hesse D, Raggio DP, Bönecker M, van Loveren C, van Amerongen WE. The effect of GIC-brand on the survival rate of proximal-ART restorations. Int J Paed Dent. 2012;23:251-8.
10. World Health Organisation. Oral Health Surveys. Basic Methods. 4th ed. Geneva, 1997.
11. Diem VT, Tyas MJ, Ngo HC, Phuong LH, Khanh ND. The effect of a nano-filled resin coating on the three-year clinical performance of a conventional high-viscosity glass-ionomer cement. Clin Oral Invest. 2013. Advance publication: DO1 10.1007/s00784-013-1026-z
12. Bhide R, Messer LB, Robertson JA. Oral health of schoolchildren in rural Vietnam. Part I. Oral hygiene, diet and dental caries. Synopses 2008;41:1-8.
13. Sivathasan D, Messer LB, Robertson JA. Oral health of school children in rural Vietnam. Part II. Dietary sugars and fluoride exposure. Synopses 2009;42:4-11.
14. Nguyen VH, Messer LB, Robertson JA. Oral health of schoolchildren in rural Vietnam. Part IV. High early childhood caries experience in pre-school-aged children. Synopses 2011;47:4-11.
15. Axelsson P. The effect of a needs-related caries preventive program in children and young adults – results after 20 years. BMC Oral Health 2006;6 (Suppl 1):S7

Colgate® Corner

by Sue Cartwright,
BDS, Dip Clin Dent, M Ed

NEW **COCHRANE REVIEW** AFFIRMS THE CLINICAL BENEFITS OF TRICLOSAN/COPOLYMER FORMULA IN COLGATE TOTAL® TOOTHPASTE

A recent study conducted by the Cochrane Oral Health Group assessed the effects of triclosan/copolymer containing fluoride toothpastes, compared with non-antibacterial fluoride toothpastes, for the long-term control of caries, plaque and gingivitis in children and adults.

This data highlighted the benefits in using a triclosan/copolymer containing fluoride toothpaste when compared with a non-antibacterial fluoride toothpaste (without triclosan/copolymer) and concluded there was no evidence of any harmful effects associated with the use of triclosan/copolymer toothpastes in studies up to three years in length.

- The triclosan/copolymer toothpaste provided a 22% reduction in **plaque** compared with control (1.70 vs 2.17; 20 studies, 2675 participants, moderate-quality evidence). It provided a 41% reduction in **plaque severity** compared with control (0.22 vs 0.37; 13 studies, 1850 participants, moderate-quality evidence).
- The triclosan/copolymer toothpaste provided a 22% reduction in **gingivitis** compared with control (0.95 vs 1.22; 20 studies, 2743 participants, moderate-quality evidence). It provided a 48% reduction in gingival severity compared with control (0.14 vs 0.27; 15 studies, 1998 participants, moderate-quality evidence).
- The triclosan/copolymer toothpaste provided a 5% reduction in **coronal caries** compared with control when measured as decayed and filled surfaces (3.27 vs 3.77; 4 studies, 9692 participants, high-quality evidence).
- There was no data available for meta-analysis regarding adverse effects, but 22 studies (73%) reported that there were no adverse effects.

The review analysed 30 studies containing 14,835 subjects that were published between 1990 and 2012.

References

Triclosan/copolymer containing toothpastes for oral health (P Riley1, T Lamont2)
In: Cochrane Database of Systematic Reviews 2013, Issue 12. Art. No.: CD010514. DOI: 10.1002/14651858.CD010514.pub2.
Full text: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010514.pub2/abstract;jsessionid=217E52E32B87ADA7C2AD66C3244DFF12.f01t03
1. Cochrane Oral Health Group, School of Dentistry, The University of Manchester, Manchester, UK 2. Dundee Dental School, University of Dundee, Dundee, UK

Up Coming *Events*

5-8th June 2014

12th EAPD Congress

Sopot. Poland
www.eapd2014.pl/home.htm
www.eapd.gr

20-23rd August. 2014

NZDA Conference 2014

Christchurch. New Zealand
www.nzda.org.nz

22-24 August 2014

9th Biennial Conference of the Pediatric Dentistry Association of Asia (PDAA),

Concorde Hotel Singapore
www.pdaa.asia/pdaa-2014-singapore/

4th October 2014

22nd Congress of the international Association for Disability and Oral health

Berlin. Germany
www.iadh2014.com

25-28th March 2015

36th Australian Dental Congress

Brisbane. Australia.
www.adc2015.com

1-4th July 2015

IAPD International Congress

"The voice of the child"

Glasgow. UK
www.iapdworld.org
www.iapd2015.org

Australia and New Zeaand Society of Paediatric Dentistry
www.anzspd.org.au

Federal President	Dr John Sheahan johnsheahan@bigpond.com
Vice President	Dr Tim Johnston timjohnston@westnet.com.au
Hon Secretary/Manager	Dr Peter Gregory gregfam@highway1.com.au
Immediate Past President	Dr Kareen Mekertichian ksmekj@bigpond.net.au

Branch Executives

Branch	President	Secretary	Fed Councillor
NZ	Dr Heather Anderson russell.heather@ xtra.co.nz	Dr Craig Waterhouse craig.shona@xtra.co.nz	Dr Erin Mahoney erinkm@ slingshot.co.nz
NSW	Dr Chinh Nguyen chinhn@ optusnet.com.au	Dr Michele Tjeuw drmicheletjeuw@gmail. com anzspd.nsw@gmail.com	Dr Soni Stephen Soni.Stephen@ sswahs.nsw.gov.au
QLD	Dr P.Y. Lai twinklelittlestar@ kidsdental.com.au	Dr Steve Kazoullis kazoullis@ pdgdental.com.au	Dr Sue Taji suetaji_dental@ hotmail.com
SA	Dr Michael Malandris dinodentist@ internode.on.net	Dr Wendy Cheung wendywsc@hotmail.com	Dr PJW Verco joverco@ verco.com.au
VIC	Dr Amy Fung amklfung@yahoo.com	Dr Mihiri Silva mihirisilva@hotmail.com	Dr John Sheahan johnsheahan@ bigpond.com
WA	Dr Peter Readman drpeter@iinet.net.au	Dr Rod Jennings rgwjennings@gmail.com	Dr Tim Johnston timjohnston@ westnet.com.au

Editor Synopses	Timothy Johnston timjohnston@westnet.com.au
Correspondence	Timothy Johnston The Editor, Synopses 8 Thelma Street West Perth WA 6005 AUSTRALIA
Artwork, printing and distribution	Colgate®
	Colgate Oral Care Level 15, 345 George Street Sydney NSW 2000 AUSTRALIA

Mailing List

The mailing list for the distribution of Synopses is maintained by Dr John Winters on behalf of the Federal Secretary/Manager of ANZSPD. It is compiled from information supplied by the Branch Secretaries. If there are errors in your mailing details, please contact Dr John Winters or your Branch Secretary. Please do not contact Colgate for address correction.

Submissions

All text for inclusion in Synopses must be submitted to the editor on CD or by email. Media will not be returned. Address email to timjohnston@westnet.com.au. Please enclose your contact details and email address with all submissions.